Competing Currencies:
Designing for Politics in Units of Measurement

Amy Voida[1], Ellie Harmon[1], Willa Weller[2], Aubrey Thornsbury[2], Ariana Casale[2], Samuel Vance[2], Forrest Adams[2], Zach Hoffman[2], Alex Schmidt[2], Kevin Grimley[2], Luke Cox[2], Aubrey Neeley[2], Christopher Goodyear[2]

[1]Dept. of Information Science
University of Colorado Boulder
{amy.voida, ellie.harmon}@colorado.edu

[2]Dept. of Human–Centered Computing
Indiana University, IUPUI
{wweller, althorns, aecasale, samvance,
ftadams, zlhoffma, as52, klgrimle, lukcox,
anneeley, csgoodye }@iupui.edu

ABSTRACT

We present results of a qualitative study of the information systems used by college and university food banks and find that their inventory systems are characterized by the patchwork use of multiple units of measurement—currencies—collected at different points in their workflow for different stakeholders. Considerations of whether to track information by item count, points, monetary value, or weight are immensely political and privilege some stakeholders over others. We contribute to an emergent body of research in computer-supported cooperative work about the ways in which the politics of measurement influences the design of organizational information systems through an explanation of the ways that these different currencies embody politics and stymie design at the most mundane level of the information system—the *unit* of measurement.

Author Keywords

Food pantry; food insecurity; inventory; currency

ACM Classification Keywords

H.5.3. [Information Interfaces and Presentation]: Group and Organization Interfaces—Collaborative Computing

INTRODUCTION

Research from a variety of domains has demonstrated the importance of attending to the ways that data and measurement shapes and is generative of practice and politics (e.g., [6, 46, 53, 67]). Prior research, often drawing on scholarship in science and technology studies, has primarily focused on understanding the politics implicated in

existing artifacts—the databases that aggregate and archive data sets (e.g. [9, 11]) or the rigidly designed data systems in specific domains, such as electronic medical records (e.g., [52]). By contrast, newer research builds on seminal CSCW scholarship on the politics of categorization [57] and classification [12] to shift attention to the ways in which our understanding of the politics of measurement can and must inform design [51].

Working across contrasting but complementary case studies in the domains of health care and environmental assessment, Pine and Liboiron [51] draw new attention to the ways that the politics of measurement are of critical importance in the formative stages of design: "the practices and premises of data creation that populate datasets themselves, shaping human-computer interactions even before data reaches the computer." We follow in this research trajectory, demonstrating how the politics of measurement are relevant to CSCW scholarship in ways that go beyond questions of what data shapes the design of the database. Here, we examine an even more mundane and fundamental piece of the design process—unpacking politics in the *unit* of measurement that stymies design even before the schema can be fixed in information infrastructures.

In 2015, we were approached by the director of a campus food pantry who asked for guidance and help in designing a computer-based inventory system. As a formative part of the design process, we interviewed stakeholders of campus food pantries across the country to understand what aspects of inventory they measured and why. Food pantries are part of a much larger, complex, and political food ecosystem, in which debates about the ethics of understanding food as a commodity versus an individual or community right abound [16]. Some scholars and activists, for example, level criticism that the assistance provided by food pantries primarily serves to absolve the government from addressing the underlying causes of food insecurity [7]. Information systems—focused on measuring and tracking the impacts and operations of food pantries—have significant

ramifications, then, for how conflicts within the food ecosystem might be accounted, discussed, and addressed. As Mol has argued:

The point of asking what is being counted is not to argue that counting is doomed to do injustice to the complexity of life. This is certain. The point, instead, is to discover how and in what ways. [47]

As a site for research, food pantries offer an opportunity for examining the stakes of design in a context where the politics of measurement arise quite fundamentally from a context of injustice and inequity. The design and deployment of information infrastructures will contribute to reinforcing and/or remedying these injustices. Our research shows that critical questions about *what* should be counted in early stages of design [51] must be augmented by questions about the *unit* of measurement. How can and should one design for a context in which multiple units of measurement, each political in their own right, collide in organizations unable or unwilling to choose among them?

Rather than operating around a centralized measurement system, nonprofit organizations, more generally, often rely on a patchwork of systems [64]. Campus food pantries, as we will show, also rely on a patchwork of measurements—tracking food by item count, points, monetary value, or weight. We characterize each of the units of measurement represented in our informants' information systems, and describe these units of measurement as "currencies," since each is tuned to a particular configuration of values held by different stakeholder communities. We describe where in the workflow these metrics are used, drawing attention to the advantages and disadvantages of choices about the unit of measurement for various stakeholders. We reflect on the patchwork of currencies that are used, the ramifications of not having a "gold standard" currency (or singular measurement system), and the implications for developing effective interventions in this context.

RELATED RESEARCH
The Politics of Measurement
A sizeable body of research demonstrates that values are instantiated in information systems, particularly through the categories that are named (e.g., [12, 55, 57]). These categories and classification systems exert political influence over how individuals and groups of individuals experience the world. Bowker and Star, for example, characterize the experience of populations marginalized through the categories that are and are not named as *torque*: "the twisting that occurs when a formal classification system is mismatched with an individual's biographical trajectory, memberships, or location" [12]. The data in databases—that which is produced through measurement—are also consequential for what might be known, and thus to what one must be accountable [53, 62]. For example, as Troshynski and colleagues argue, GPS-based measurements of location shape the experience of those measured (surveilled), creating new accountabilities; measurement does not just generate data for consumption, but is implicated in the production of social life and lived experience [62].

Far from being neutral or objective reflections of the world, monitoring, measurement, and accounting practices are implicated in giving rise to new "audit cultures" characterized by transformations in social understandings of what counts as "good" practice [56]. Scholars have noted the political, epistemological, and gendered biases implicated in the uptake of so many new forms of data-based measurement (e.g., [13]) and have foregrounded the consequences of such measurement on work practices [5, 52]. In numerous studies of the development and roll-out of electronic health records, researchers have shown how measurement and recording shape medical practice, conceptualizations of "good" care, and the meaning of values like "safety" (e.g., [6, 52]). For example, in studying the rollout of a new electronic medical record (EMR) system, Pine and Mazmanian argued that:

The institutional logics of 'safety' embedded in the EMR create negative organizational outcomes, effectively undermining coordination and necessitating inaccurate accounts of work. [52]

Similarly, Benjamin and Campbell warn that many of the critical forms of work carried out by human services organizations do not match the genres of work tracked by standard models for outcome measurement [5].

Research in the politics of measurement, then, demonstrates that measurement tools and practices shape human action and understandings of reality in politically important ways. As Bowker asserts, "the database itself will ultimately shape the world in its image: it will be performative" [10]. And as Pine and Liboiron have argued, the possibilities for this performativity are crucial for HCI researchers and designers:

Since computing technologies such as databases, algorithms, and information entry interfaces, are designed around measurement; the development of measurements and the politics they embody can shape HCI design before it has even begun. [51]

And as they further demonstrate through case studies of measurement in environmental science and medical care, it is not just the tools of measurement, but also the choice of *what* to measure that is a political act—and one specifically relevant to research and design in HCI:

Measurements… exercise covert political power by bringing certain things into spreadsheet and data infrastructures, and thus into management and policy, while leaving other things out. [51]

Research in the politics of measurement highlights the processual politics involved in negotiating and deriving a singular metric to characterize disparate qualities or objects—a process referred to as commensuration [27, 28]: "the expression or measurement of characteristics normally represented by different units according to a common

metric" [27]. Espeland and Stevens note that inconsistency and contradiction are…

> *…sites of deep struggle… [in which] claims about incommensurables are likely to arise at the borderlands between institutions, where what counts as an ideal or normal mode of valuing is uncertain. [28]*

And yet, scholars also acknowledge that "inconsistency and contradiction between institutions can be opportunities for social innovation and change" [27]. Leveraging the design process as a means of foregrounding differences, fostering empathy, and scaffolding dialogue has been a key contribution of the field of human–computer interaction (e.g., [14]). While research in the politics of measurement asserts that politics is part and parcel for how individual metrics are negotiated and derived, we turn in this research to foreground a context in which organizations are struggling to negotiate multiple metrics in the design process—interrogating the design challenges that present themselves when processes of commensuration are *not* seen as being a productive path forward and when the ability to navigate and leverage multiple metrics is valued above even the mission of the organization, itself.

Much prior scholarship on the politics of measurement has focused on medical [6, 51, 52], scientific [9, 10, 11, 51], academic [56], and legal [53, 62] contexts. As measurement is increasingly implicated beyond these professional contexts, there is a need for research that investigates the politics of measurement in a wider array of situations. Recent years have seen the emergence of new scholarship examining the "quantified self" movement (e.g., [8, 49, 68]), for example, as measurement is newly implicated in personal life. Research in these settings has drawn new attention to the imbrications of data and measurement with affect and personal experience—issues not always at the fore in professional contexts. The situatedness of measurement and the stakes of systems design in the nonprofit sector are different than in previously studied institutional contexts. In medical and scientific domains, the computing tools implicated in measurement (e.g., electronic medical records or a scientific database shared among multiple researchers or institutions) are often designed specifically for use by a specific organization or even the broader domain. Researchers, in collaboration with institutional decision makers, are positioned to provide suggestions for altering systems design with the potential to make real impacts (e.g., [31]). The nonprofit sector, by contrast, is characterized generally by constraints in resources and technical expertise that have contributed to the appropriation of assemblages of general-purpose tools for information management [64]. As our research begins to show, the situatedness of measurement in nonprofit contexts—especially ones in which there are no centralized systems or standardized measurement tools—raises new challenges for how CSCW scholars might respond to the diversity of contexts of contemporary IT use.

Food Pantries and the Food Ecosystem

Food pantries play a part in a much larger, complex, and political food ecosystem. Food pantries emerged in the United States in the late 1970s as an unanticipated consequence of the Food Stamp Act of 1977 [22]. Previous instantiations of the food stamp program required households to 'buy in' to the program, purchasing food stamps at a highly subsidized rate. Antihunger advocates criticized the purchase requirement for preventing the neediest households from benefiting. And indeed, within a month of the passage of the Food Stamp Act, which removed the 'buy in' requirement, the food stamp program enrolled 3.6 million additional households. Yet the elimination of the purchase requirement also disincentivized households from budgeting for food above and beyond that allotted by the program, effectively reducing their overall buying power. Food pantries—bolstered by government surplus commodity distribution and by the emergence of Second Harvest, a nonprofit organization that provides infrastructure for smaller food pantries and for the for-profit food industry to donate to food pantries—emerged to fill the gap.

Campbell emphasizes that conflict is "rampant" within the US food ecosystem, with conflicts occurring at "epistemological, political and institutional, socioeconomic, spatial, community, and organizational levels" [16]. She categorizes stakeholders based on their alignment with either the global industrialized food system (this includes food pantries)—for whom food is valued as a commodity and/or entitlement—or with the alternative food system—for whom food is an individual and community right.

Framed against this historical backdrop and competing value systems, there is a history of criticism of the role of food pantries in the larger food ecosystem. Berry, for example, exemplifies concerns that private food assistance shouldn't absolve the government from addressing the problem:

> *Handouts are not the most appropriate way of addressing the hunger problem…. Food banks distract attention away from programs that work and thus the pressure on government to stop cutting those same programs. [7]*

Tarasuk and Eakin also question the role of food pantries in contributing to corporate welfare by accepting any food donations, regardless of nutritional value or quality [59].

Finally, there is abundant research demonstrating that the food provided by food banks is insufficient to address food insecurity [37, 38, 59]. Items obtained fall short of recommended nutritional guidelines. Fresh foods, for example, are difficult to obtain, as these items are expensive and have short shelf lives [38]. Tarasuk and Eakin characterize the services of food banks as "symbolic assistance" [59] while Tarasuk and Beaton criticize the donor-driven nature of these organizations:

> *Given the supply-driven (i.e., donor-driven) nature of this system and the fact that demand for food assistance*

has long surpassed supply, food banks cannot be expected to resolve the kinds of food problems described here. More effective responses, ideally addressing the severe and chronic poverty which underlines household food security and other manifestations of household economic insecurity, are urgently needed. [58]

Especially in an ecosystem plagued by such deeply-rooted conflict, measurement matters for the ways that organizations orient towards other stakeholders and operationalize their missions. Information systems of measurement have significant ramifications for how the conflicts within the food ecosystem might be accounted, discussed, and addressed.

Technology and the Nonprofit Food Ecosystem
The present research contributes to a nascent but growing body of work examining the use of information systems in the food ecosystem. Dombrowski and colleagues' research to understand the challenges of local organizations working with food-insecure populations highlights the difficulties of collaboration among organizations when "the variety of skills, information resources, and technologies used to collect and aggregate information about clients and food resources is diffuse and highly varied" [23]. A lack of interoperable infrastructures and information systems exists both at the ecosystem level and within individual organizations, hindering organizations' abilities to derive benefit from data that is collected, but siloed across different information systems [45, 64].

Research about technology use in nonprofit organizations almost universally highlights the extraordinary constraints in resources and expertise that shape technology use (e.g., [23, 41, 45, 64]). In the context of the nonprofit food ecosystem, these constraints force organizations to scope their services and geographic service areas, resulting in a temporal and spatial patchwork of resources and services that clients and outreach workers must learn how to navigate [23].

The absence of integrated technology, constraints in funding, demands by primary stakeholders such as funding agencies, and reliance on volunteers "prevents many nonprofits from… understanding and reporting on their effectiveness, and from embracing potentially helpful new technology" [65]. The role of information systems in program evaluation and reporting is also complicated by tensions between the reporting requirements established by funding agencies and the work and mission of human services organizations [5]. Nonprofit organizations are under increasingly intense pressure to demonstrate their effectiveness to public and private funders [34]. Data collection is, therefore, a significant part of the work that nonprofits do. Yet as one commentator in the *Stanford Social Innovation Review* lamented: "Nonprofits are often collecting heaps of dubious data, at great cost to themselves and ultimately to the people they serve" [54]. Studies of performance and accountability in human services nonprofits suggest that current data collection practices may fail to capture important outcomes

of nonprofit work and inhibit performance [5]. Metrics matter in the design of information systems [51], and conflicting assumptions about nonprofit accountability and performance further complicate the design and uptake of information systems in the nonprofit food ecosystem.

METHODS
At the invitation of the director of a campus food pantry, we undertook formative research to inform the design of a computer-based inventory system.

Research Context
As of March 2016, The College and University Food Bank Alliance had identified 286 active food banks on higher education campuses across the United States [19]. Research on the prevalence of food insecurity—"whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain" [2]—among college students is sparse, and various studies use different measures of food insecurity that are difficult to align. Nevertheless, all studies report levels of food insecurity among students that are at least as high—and often higher than—levels among the general population [18, 29, 30, 50]. In 2014, for example, 14% of U.S. households (48.1 million people) experienced food insecurity; 19% of households with children (including 7.9 million children) were food insecure [63]. In comparison, rates of food insecurity among community college students (39.2%) and rural university students (59%) were among the highest reported [29, 50]. Numerous questions exist about why college students are experiencing high rates of food insecurity, as well as questions about what impact food insecurity has on educational, health, and behavioral outcomes at the college level [15].

Food pantries, in general, are compelling sites for understanding the politics of measurement, as standards for measurement are still in flux. Moreover, while the research presented here emerged from pragmatic collaborative origins, campus food pantries serve as a particularly compelling site for study because they report to a larger assemblage of institutional stakeholders—including college or university administrators—than do community food pantries. In addition, the potential for impact measurement extends to include measures of academic success, as well. Campus food pantries are in a pivotal position to enable critical research about the experience and impact of food insecurity in the context of higher education. Their information systems will be key for collecting the data to characterize the populations served, the services rendered, and the outcomes of these services—their impacts on the education, health, and futures of food insecure students.

Informants
We recruited informants for this research from campus food pantries that we identified through the online membership list of the College and University Food Bank Alliance [19]. All campus food pantries were located in the United States and were distributed across the Pacific Northwest, Midwest,

South and Northeast. Campus food pantries ranged from being less than one semester to 22 years old.

We recruited 22 informants from 8 different colleges and universities who self-identified as working in some way with their pantry's inventory information. Informants included both students and staff members; roles and job titles included volunteers, volunteer managers, pantry or inventory directors, outreach directors, and advisors. Informants' length of involvement with their campus food pantries ranged from just a few months to multiple years.

Data Collection
We conducted semi-structured interviews with 22 informants; 13 individuals were interviewed in person and 9 individuals were interviewed over the phone. Interviews lasted 30 minutes, on average. 10 different researchers conducted the interviews, either individually or in teams of two; all interviewers used the same interview protocol. Interview questions focused on the role of inventory-related information across the work of the food pantries: where inventory comes from, what information is tracked about the intake and outflow of inventory, what information about inventory is shared with what stakeholders, and how information about inventory influenced how the pantries understand their clients' needs. Interviews started with concrete questions about current information systems and practices and ended with more speculative reflections about what information and systems informants ideally would like to have. The semi-structured interview format allowed us to be more responsive to and better understand informants' different perspectives on inventory information based on their diverse roles within their pantries.

In all of the face-to-face interviews, informants were additionally asked to sketch their understanding of the inventory process through a map or diagram, with annotations of information flow, media and technology used to manage or share information, and stakeholders in the process. Diagrams were used to create common ground between the informant and interviewer(s) and to facilitate the recall of details captured in the interview.

All interviews were transcribed for analysis that was interleaved with ongoing data collection.

Data Analysis
Researchers met weekly and collaboratively analyzed the interview transcripts using grounded theory [20]. From the broad set of categories generated during inductive, open coding, we identified higher-level themes and relationships among categories, using affinity diagramming to facilitate axial coding. Initial clustering focused on the different kinds of information shared with different stakeholders. Here, we noticed that interactions with different stakeholders largely relied on data collection and reporting using different units of measurement. Through subsequent iterations of affinity diagramming, clustering focused on the different units or currencies of inventory used with different stakeholders

(e.g., item count vs. monetary value of the item). The tensions among, politics involved with the use of, and design challenges associated with different currencies emerged through the process of theoretical integration.

THE "INVENTORIES" OF FOOD PANTRIES
Although we were initially invited to assist a campus food pantry in understanding how it might better track the throughput of its food inventory, our interviews revealed that food pantries were actually tracking the throughput of two different assets: food and clients. Despite the impetus for the research, food, as it turned out, was often not the most important asset for campus food pantries to track. Many food pantries tracked information about the comings and goings of their food inventory informally and incompletely. In contrast, all campus food pantries tracked the comings and goings of their clients with more formality and completeness:

So, the thing that is getting tracked every single time is the [ID] swipe. Ok? So, the people who are using the pantry, they're being swiped… so we can, you know, accurately report how many people are using the pantry…. So that's pretty solid information. (I8)

Informants suggested that for campus administrators and larger food bank distributors, the most valued information about the work of the food pantry was information about how many clients walk through their doors, regardless of how much or what kind of food they take with them:

To be able to have this easy-to-use data sheet to be able to give that information out that is very critical to donors, alumni… people who are truly invested in [this] campus, to say: 'This is the impact that you have made. This is how many lives you have changed.' (I1)

In that packet there, there's basically the information we track… on the new client form…. So the key part for the database for us is just being able to track our numbers served, so that we can report those, because we have to report those to [our food bank distributor] every month, because they, then, report to Feeding America. (I11)

Clients were seen as assets to the organization, useful "when [administrators] want a convenient photo opportunity" (I7) that will reflect positively on the university. Increasing the number of clients signaled a meaningful effort by the university to serve its student population and provided leverage to ask for more resources from donors.

Other client data was used in different permutations to gauge an individual's eligibility for being served—whether based on their campus affiliation, per-visit eligibility, and/or their need. All of the food pantries in our sample served students; some also served staff and faculty; only a few extended their service to other local community members. The majority of food pantries in our sample required that clients "prove" (I13) their eligibility, often by showing or scanning a university ID card. Pantries typically capped the number of times that a client could visit the pantry. Internal information systems (e.g., databases, spreadsheets, or pen-and-paper)

were used to track how many times a client had visited the pantry in a given period, so that a volunteer could check their eligibility. The majority of food pantries in our sample informed clients that services were "need-based," but no organization verified any income or financial information. One informant noted that clients were required to sign that they met the financial requirements, but added that, "we don't ask… [for] the income at all" (I11).

Considering clients as the most salient asset of campus food pantries seems to most strongly benefit the university administration and, perhaps, others who are advocating on behalf of the food pantry to external stakeholders. Yet, this approach to metricizing the work of food pantries frames clients most negatively, as a stakeholder who needs to be monitored and whose activities need to be tracked and constrained (see also [53]).

While granular information about client visits was used to monitor eligibility for services, at an aggregate level, all campus food pantries used just a single unit of measurement to track clients—the total number of client-visits. This unit of measurement did not attempt to track clients at an individual level, rarely recognizing the number of unique individuals served, nor did it offer any data about the impact of the food pantry on the physical or academic well-being of these students, a concern that we will return to in our discussion. The design of client-focused information systems suggest that client headcount is collected and used more as an organizational asset than as a population of concern—rendering clients as a form of human inventory, tracked alongside food inventory.

The values that are reflected in the categories of inventory-related information systems surface in debates over whether or not to include community members in the clientele of a campus food pantry and debates over whether to track or make public the fact that faculty members have sought out food assistance. Fundamental decisions about *what* to measure are political acts [51], whether the focus of measurement and the allocation of technical resources should be oriented towards tracking food or people (see also [44]). But in this research, we also find values and politics that stymie design in an even more mundane level of the information system—the *unit* of measurement.

COMPETING CURRENCIES OF FOOD INVENTORY SYSTEMS

Different campus food pantries, for the benefit of different stakeholders or at different points in their workflow, use different *currencies*—units of measurement tuned to a particular configuration of values held by different stakeholder communities—for tracking their food inventory. Once fixed in the schemas underlying information systems, the unit of measurement—a seemingly mundane design decision typically made early in the design process or even assumed as obvious with little explicit debate—influences how the system privileges some stakeholders over others and

is implicated in the politics of an already-contested food ecosystem.

Item Count

In many campus food pantries, inventory is tracked by item count—sometimes as food comes in, sometimes as it sits on the shelves, and sometimes as it leaves the pantry with clients. The tracking of donations by item count is often motivated by a desire to provide feedback to campus-level groups of donors. Often, tracking by item count facilitates competition to see which donor group can collect the most food for the pantry and item count is an easy enough currency for any potential donor to understand:

They always resort to competition about who can bring in, you know, the most sort of food items, and have some prize for the person who does or the [fraternity or sorority] chapter that has the most…. It's tangible counting the number of items…. (I7)

Item count is also used to monitor what the pantry currently has on its shelves as well as what is needed. Here, the exactness of the item count isn't important; rather, it is more of an "eyeball process" (I13). Sometimes, when the number of items available in a given category seems to be running low, pantries will add that class of item to a wish list on a website or make a special request via social media.

Item count is also used to track the amount of food taken from the pantry by clients. Many pantries have set a number of items (sometimes per food category) that a client can take from the pantry during each visit, for example:

You can only take out 4 items of each product…. If you get Chef Boyardee cans, you can only take out 4 of those items, 4 granola bars…. So we can kind of make sure that you're not coming in and taking 50 packs of an item…. There needs to be enough to go around for everybody. (I12)

Item count is also used by several campus food pantries to communicate impact to external stakeholders, both within the university and in the surrounding community. In one campus food pantry, for example, whatever volunteer is working on a given day counts the number of items leaving the pantry and tallies this information by hand on a sheet of paper. That volunteer then hands off the tally sheet to a pantry advisor who "tall[ies] everything up into a nice little spreadsheet" (I1). This information is then reported to external stakeholders:

We needed to report out, 'Hey, so this is the impact the pantry has made over the past year and a half….' Having this information to tell our story… of impact is huge, and to be able to have it on hand, to have it quickly, is incredible. (I1)

Advantages of item count as a currency include its flexibility and ease of use, especially among new volunteers or clients. Disadvantages of item count as a currency may include the inexactness of methods used to track inventory with this currency. Using item count as currency also privileges some

stakeholders over others. While it facilitates feedback to donors and supports competitive motivations for donating, for example, it motivates an emphasis on the quantity rather than the quality of donations. In addition, the currency of item count also supports rationing among clients, a practice found by Tarusuk and Eakin to effectively ensure that the impact of food banks is symbolic, at best [59].

Points

A variant of the item count currency, points are only used at a few pantries in our sample. Under this regime, the value of each item is theoretically pre-determined by a food pantry administrator, for example: "Hygiene items are two for one point, usually, and then other miscellaneous items are typically one point. We are not super strict so that is subjective" (I8). More valuable items require more points.

With points as currency, clients are allocated a certain number of points to spend in the pantry in whatever way they desire. Yet, in each food pantry that identified points as currency for this phase of the workflow, volunteers reported significant subjectivity in how points are assigned to food items, creating inconsistencies from week to week:

There are some variable items that we need to be able to assign points to them and that gets tricky because people that use the pantry will come and say, 'Last week this was a half point and now it's a full point.' So there is a different volunteer working and it gets frustrating and it is not consistent. That is something that is difficult to control—how much is a single item worth when we don't have a history or log of it. (I1)

The use of points is also applied flexibly and inconsistently by different volunteers:

That's the problem, it kind of depends of the volunteer, a lot of volunteers aren't assertive to enforce. (I2)

As a form of currency, then, points are better able to reflect the differing value or quality of food. The subjectivity of this unit of measurement, however, also tends to more strongly emphasize the power inequities between client and volunteer, leaving it up to the volunteer to determine what points will be assigned on any given day and whether the points matter, at all.

Monetary Value

A minority of campus food pantries in our sample emphasized the monetary value of food as currency. These pantries had typically worked through the bureaucracy associated with obtaining their own 501(c)(3) status, which is required for accepting tax-exempt donations in the United States. Without this status, both individual and organizational donors can be discouraged from donating. Here, the primary motivation for tracking monetary value as currency is to be able to report the value of the donation back to donors for their tax records:

When we were first starting to do research on how this food pantry would work, we consulted the Gleaners….

They said that at that time they were not ready to be giving to public institutions… there's some red tape around the tax stuff…. Now since we're able to put a value, like a dollar value to whatever it is that they're donating, we are able to get 'in kind' donations to the foundation. (I1)

Campus food pantries that track inventory by monetary value use a diversity of means to attract and accept monetary donations, including soliciting corporate 'in kind' donations, supporting payroll deductions, accepting gift cards to grocery stores, and distributing tip jars at coffee shops around campus.

Campus food pantries that emphasize monetary value as currency also emphasize that monetary donations actually go farther than food donations because the pantry has the ability to buy wholesale:

[Where a donor could buy one,] we can buy three cans, so that's sort of the little spiel I try and try and communicate to people so they can understand that because we have this ability to buy your 33% at wholesale…it really is more effective for them to donate money to us. (I11)

Thus, the advantages of using monetary value as currency not only benefit donors who want to make tax-deductible contributions; this currency also indirectly benefits clients because monetary donations can be used much more flexibly to stock the pantry with food that is of greatest need to the clients, whether for "emergency buys"—"so when the pantry is running low, we actually go out and buy food to keep it stocked" (I5)—or to supplement food donations with genres of food that are not as frequently donated, "so that we can reach more into refrigerated goods and stuff like that" (I10).

Weight

When campus food pantries have enough space to operate at scale (not all have been allocated enough space on campus to do so; some are literally working out of closets), they are able to accept large donations (e.g., by the crate instead of by the can). In these contexts, tracking food inventory by item count is not feasible. An alternative currency based on weight offers the possibility of giving easily measurable feedback to donors in a manner that conveys the scope of the donation without the overhead of counting individual items:

It was easier to weigh than it was to count it…. We try and keep track of… 'OK, this crate of food came from the nursing building.' So we can report back to that office and say, 'Hey, thanks for the donations! You were able to supply 500 pounds of food.' (I1)

Two organizations in our sample were affiliated with larger food bank suppliers, and the currency of weight was additionally used to manage these affiliations. Operating with weight as a currency, however, requires more expertise than other currencies; advance training and planning was required to ensure that someone in the organization knew

how to translate the needs of the pantry into crates of food ordered by weight:

If somebody is new, it takes a couple orders to know, well, exactly how much to order of everything. You don't see what it is. You see numbers as in how much comes in a case of something, then you see a weight. But at first you really have to get an idea of what that really means and see what really comes in. So you see, 'OK, I ordered this and this is what it looks like. I need to adjust accordingly next time.' (I14)

Thus, while weight has the advantage of better supporting large donations, and was easier to use than item count for an established pantry with regular and experienced staff, it was not as well-suited to less established organizations, or for volunteer-driven organizations with regular turnover.

DISCUSSION: THE STAKES AND CONTEXT OF INTERVENTION
From Units to Systemic Change
As Taylor has argued, systems design and implementation is a process of 'world making' [60]. Design decisions matter not just for the affordances of the final artifacts and their *use*, but in the mundane assumptions they perpetuate about what is possible in the world. Design participates in the infrastructuring of society, and the most mundane details—decisions about what to measure, how to measure, and, as we have shown, with what *unit* of measurement—matter for shaping the kinds of political work that are possible and for the futures that people might imagine, advocate for, and work towards.

For the campus food pantries in this research, not only do different currencies privilege different stakeholders at different stages of the inventory process, different currencies shape different possibilities for the future of food pantries within the highly contested food ecosystem and different possibilities for how society can envision addressing the systemic social problem of food insecurity. World making through item count or weight, for example, suggests possibilities for solidifying the role of food pantries in the nonprofit ecosystem, for imagining futures in which individuals who are food insecure might rely on food pantries for providing whatever food has been donated by increasingly powerful corporate donors. World making through alternate units of measurement—nutritional value, for example—suggests possibilities for imagining futures in which food pantries play an important role in advocating for the health and wellbeing of food-insecure populations.

Reflecting on the systemic implications of something as mundane and unassuming as the unit of measurement highlights the extent to which inventory systems also work to reify the role of food pantries in the food ecosystem. Organizations have self-preservation in their own self-interest, and it is no surprise that information systems reflect this self-interest. Yet, many researchers have argued that food pantries are not the solution to food insecurity (e.g., [7, 59]) and further reifying an existing set of currencies through the design of new inventory systems, while classically 'good' user-centered design, perhaps means that as designers, we, too, become complicit in reifying the role of the food pantry in the food ecosystem. Where user-centered design favors a conservative approach to maintaining the status quo [3, 43], this research case suggests the need to consider whether and when we, as CSCW scholars, have responsibilities to work in ways that might thwart the continued reification of pre-existing social relations. The smallest design decision—the unit of measurement—fixed in the schema early in the design process has significant implications, then, for this high-stakes, systemic social issue and the ways in which we do and do not choose to intervene.

Implications for Intervention
In designing for food pantries, there is a multiplicity of stakeholders, distributed across different positions of power—including powerful stakeholders beyond the organization, itself—who unequally shape decisions about measurement. Traditional methods for intervening in such situations might include participatory design or interdisciplinary design teams of ethnographers, designers, and software engineers. Yet, these methods require that researchers are in a position to influence the design processes and alter systems in response. While these methods might be viable for some projects in measurement—e.g., collaborative research to influence systems like electronic medical records [52, 31]—they are less realistic in the case of food pantries. Campus food pantries often rely on assemblages of off-the-shelf software (e.g., Excel) to track their inventories, similar to the homebrew databases identified by previous research on information management in nonprofit organizations [64]. There is often no specific system or tool being used that could be the focus of redesign. Intervention in this context, then, requires a different form of action, centered not only on affecting the design of a specific measurement tool. Instead, we find the need to influence understandings of systems already in use and over which researchers and designers may have little direct control or influence.

There are new opportunities, then, to imagine different and broader impacts of our research—beyond implications for design. For example, many of the questions raised by this research center on the ways that problems are framed about food provision and food insecurity. Measurement allows us to see things we did not see before [47, 51], playing a critical role in problem formulation. If we recognize that the politics of measurement already manifest in decisions about the *unit* of measurement, then we may be able to find new opportunities to intervene by attempting to shape discourses of problem framing—and available metrics—more generally. Even if not directly involved in designing the systems that a food pantry uses, we might design tools to make new kinds of measurement available in the first place. We might work to influence the stories told about technologies and the promises of measurement (e.g., [33]). Telling stories about what is 'wrong' and what should be changed, for example, is a kind of problem framing, an

activity with which designers and researchers have unique experience and skills; these skills could be translatable beyond the framing of problems with isolated technologies (e.g., [23, 25]) to help frame larger-scale issues and alternative opportunities for intervention. Emphasizing that infrastructures are often built atop or extend other infrastructures [26, 48, 57], researchers have also advocated for "growing" infrastructures rather than "designing" or "building" them [26]. Towards these ends, some researchers have experimented with creating alternative, augmentative, or parasitic systems to sit alongside existing computing tools to alter the context(s) in which the existing tools are used (e.g., [35, 36]). Following along these paths, we might find new avenues for intervention in complex and thorny systemic issues where computing systems are implicated but systems design is not. These avenues for intervention will require renewed engagements with politics (see also [43]) and a recognition of the ways that our own relations—as CSCW scholars—with the organizations that we study and the systems that they use are being reconfigured as computing technology becomes everyday and is no longer produced within contexts where researchers have clear opportunities to exert direct control.

DESIGNING IN LIGHT OF COMPETING CURRENCIES

Given the stakes and constraints of design in this context, we turn to consider two potential paths forward.

Design in the Absence of a 'Gold Standard'

Different campus food pantries relied on the multiplicity of currency options in slightly different permutations. No one pantry had selected a single 'gold standard' currency to manage their inventory throughout the workflow. All pantries altered their data collection at different stages of the process to accommodate the units preferred by different stakeholders—each currency allowing pantries to (re-)measure inventory in a way that aligned with a particular stakeholder's needs.

One campus food pantry, for example, used four different currencies at different points in their workflow—monetary value, weight, item count, and client headcount. This campus food pantry focused exclusively on soliciting monetary donations so that donors would receive evidence of the value of their donation. The pantry ordered food from a large food bank distributor and tracked those orders by weight. When the director of this campus food pantry spoke of their inventory, for example, it was in reference to the total weight of food ordered over a year, "We did 67,000 pounds last year" (I11). When clients arrived at the pantry, they shopped for food based on item count. And reports sent back to food bank distributors referenced only the number of clients served. No one currency is used consistently throughout the process; indeed, inventory isn't tracked throughout the process. Instead, the organization relies on snapshots of data—momentary characterizations of their inventory using different currencies at a given point in time.

The most intuitive (or naïve) understanding of inventory—stock on the shelves at any given time—was, in fact, only tracked by one campus food pantry. This pantry sent student workers to count items on the shelves manually. Incoming and outgoing inventory were also tracked, but separately—by weight for incoming donations and by item count per client for outgoing inventory (although the count of stock on shelves wasn't decremented as a result of outgoing inventory; stock on shelves was simply re-counted afterwards). Every other pantry reported using some variant of an informal "eyeball process" to gauge what items needed to be purchased or requested of donors.

The role of the inventory system in this context, then, isn't typical of the role that it plays in production and manufacturing. Instead of embodying logics of efficiency and accuracy, the inventory systems of campus food pantries embody logics of rhetoric. Assemblages of different, homebrew information systems [64] have been creatively appropriated to provide snapshots of data at different points in the workflow, in units of measurement tailored to different stakeholders. Different currencies provide important rhetorical power with different stakeholders, and pantries' ability to work flexibly and fluently within an ecosystem of systems and currencies enable these organizations to leverage data for political ends (see also [51]).

Many accounts of politics in units of measurement center around processes of commensuration, the negotiation of a singular metric (e.g., [27, 28]). And the design of computing systems is generally predicated on fixing the unit of measurement embedded in the schemas that organize, structure, and constrain data early in the design process. But for campus food pantries, there is no move toward commensuration. Such a move would, in fact, undermine their ability to communicate in strategic ways with the diversity of stakeholders to which they are accountable for critical resources.

As Espeland and Stevens suggest, commensuration has been understood as a process for balancing the preferences of multiple stakeholders:

> In decisions characterized by disparate values, diverse forms of knowledge, and the wish to incorporate people's preferences, commensuration offers a rigorous method for democratizing decisions and sharing power. [27]

But for the human services organizations in this study, there is no such democratization of decisions or sharing of power. Funders, donors, and university administration remain dominant influences and the pantry's relationship with each is cultivated around whichever unit of measurement is demanded or expected by these external stakeholders.

In grappling with the messy politics of measurement in both health care and environmental studies, Pine and Liboiron expand on Liboiron's construct of "charismatic data" [42]: "Some data is more 'charismatic' than others, meaning that

it inspires action more than other forms of evidence" [51]. Pine and Liboiron argue that choices about what to measure can be points of leverage for advocates and designers to spur others to action. As they describe in their own cases:

> *By purposefully choosing blood as the measure of maternal morbidity and presence of feces as the measure of dangerous water, the agents in our case studies were attempting to make a problem manifest that had heretofore been invisible, and thus introduce solutions that may not have been viable before. Their efforts to make a type of harm apparent through measurement made a new entity. That entity was crafted in such a way that it was actionable. [51]*

Informants in this study are well-versed in the rhetorical power of measurement, simultaneously wielding multiple units of measurement as points of leverage for external stakeholders. Yet, the power dynamics among the stakeholders involved with campus food pantries stands in contrast to the power dynamics among stakeholders in the work of Pine and Liboiron [51]. Charismatic measurements were politically useful for Pine and Liboiron's informants because their informants were in positions to act as advocates and to determine (or at least influence) what measurements to make. In campus food pantries, however, we find a more complicated arrangement of power relations, resulting in experiences of torque for multiple classes of stakeholders, raising questions about who is (and is not) able to leverage the politics of measurement—and *for* whom?

Campus food pantry stakeholders have multiple, conflicting interests. The charismatic currency serving the ends desired by donors and funding agencies is different from that serving the ends desired by food-insecure populations. Indeed, many food banks devote time and energy to tracking food inventory in multiple ways precisely because of the many misalignments of measurements and stakeholders. In scrambling to satisfy numerous external stakeholders, campus food pantries are marginalizing their own ability to advocate for their own charismatic currencies—prioritizing, instead, the currencies that are most charismatic for funders. As a result, campus food pantries are experiencing torque at the hand of infrastructures that they have, themselves, created. Pantry volunteers experience torque as they wrestle with whether to disregard a "points" system and allow their peers to take more food from the pantry than had been allotted by the currency selected by the food pantry to ensure that the organization will endure for the next client. Pantry clients experience torque in having to select food for the week given the unpredictable donations encouraged by the currencies selected to cultivate donors.

Choosing charismatic currencies means taking sides. Making choices in favor of one stakeholder group means making choices against another. Making choices in favor of many stakeholder groups—trying to manage multiple, competing currencies at once—also means giving up other work and other organizational goals, as resources have to be reallocated to managing the messiness of a system that tries desperately to be all things to all people.

As CSCW scholars, recognizing that charismatic currencies are useful for advocates, then, also requires us to ask who is (and is not) an advocate, who can (and cannot) be an advocate, what are (and aren't) they advocating for, whose interests does that advocacy serve and whose interests does it not. These are fundamental questions about who can leverage the politics of measurement—especially when decisions about the unit of measurement are out of the hands of many stakeholders.

In the case of campus food pantries, there is no easy answer to the question of whose interests are the 'right' ones to promote. There is no easy answer to the question of which currencies, charismatic to which ends and for whose benefit, should be instantiated in design. How should we then intervene as designers? While 'good' user-centered design might suggest supporting the work practices of the organization—better enabling the creative assemblages of data in multiple, competing currencies— there are significant political implications to designing a new inventory system that will privilege the organization in its diverse rhetorical work with external stakeholders. Whose advocacy will be enabled by ready-at-hand snapshots of data about donor contributions and client tracking? And who would be unable to leverage those politics of measurement?

Even as the inventory practices of campus food pantries stymie design because of the multiplicity of competing currencies they leverage, the currencies in use are also insufficient to serve the needs of a diversity of stakeholders beyond funders and administrators. Before proceeding with any system design, then, it is critical to consider what alternate currencies—units of measurement not yet in active use—might have to offer, and whether they should be taken into account as the design process moves forward.

Alternate Currencies for Valuing the Work of Campus Food Pantries

The mission statements of various campus food pantries signal a much more specific desire to enhance academic success by providing for the nutritional needs of their clients, for example: "…fulfilling the need for an adequate food supply to promote success" and "we know that inadequate nutrition decreases academic performance..."

This acknowledgement of the critical relationship between food security and educational success is one that is backed by prior research with students at the elementary and high school levels [1, 40, 66]. Yet, the ability to assess the role of campus food pantries in meeting this aspect of their mission is completely missing from the currencies represented in existing information systems. And the information systems of these pantries, tuned to either provide affirmation to donors or set restrictions on clients, are not well suited to characterizing the actual impact of the work of food pantries on the lives of their clients.

The *nutritional value* of food provided by a food pantry is a currency that has been successfully tracked by researchers—but for only one month and at great manual cost, requiring immense informational overhead [21]. To manage this at scale would require either an extensive RFID or barcode-scanning infrastructure, integrated with a variety of databases. Even with researcher intervention, rolling out—let alone maintaining—an infrastructure with this level of complexity would be beyond the realistic capability of nearly all campus food banks that participated in this research. The greatest infrastructural needs of our informants were much more pragmatic, e.g., having enough space and the electrical infrastructure needed to keep perishable food cold. Yet, the campus food pantries in this research are so much smaller in scale than community food pantries, these might be precisely the right organizations to serve as research partners in the deployment of pilot systems to explore the feasibility and value of instantiating systems based on this alternate currency.

The mission statements of campus food pantries also suggest that understanding *client outcomes* is critical. However, client outcomes cannot be measured by tallies of how many clients walk through the door. In service of this mission, it is critical to find ways to manage information about the impact of the campus food pantries on their clients' wellbeing, including their health and educational outcomes. Research that tracks educational outcomes, in particular, has been advocated for in previous research on food insecurity among college and university students [15], but the infrastructural challenges with collecting this data are—once again—significant. Campus food pantries that already log students in with campus ID cards are at a technical advantage, having built on the installed base in the university context. The affordances of these existing infrastructures stand to enable new triangulations of data that would be difficult to scaffold and aggregate in community food pantries Yet, there are significant legal barriers to accessing student records, especially by the students who (by and large) run campus food pantries. The feasibility of collecting and analyzing data about clients' use of campus food pantries is not clear at all.

In general, however, exploring the feasibility of alternate units of measurement stands to be a powerful force in re-shaping relationships with key stakeholders and aligning—or negotiating among—multiple activist agendas. Exploring the feasibility of alternate units of measurement might allow campus food pantries to reframe the discourse and begin to advocate for their mission and the interests of their clients.

In the case of campus food pantries, little is known for certain about the prevalence of food insecurity on college campuses, about the experience of food insecurity among college students and staff members, and about the long–term effects of food insecurity in this context. We find, then, that deeply understanding the design space of alternate currencies—including and in addition to nutritional value and client outcomes—requires first understanding the experience of those individuals who have not been able to leverage the politics of measurement, whose voices are not at the table, but whose futures—future health, future wellbeing, future degrees, and future careers—are fundamentally implicated in a design decision at the most mundane level of the infrastructure.

Just as our assumptions about the role of inventory systems have been called into question in this formative research, our assumptions about for whom we are designing have been called into question, as well. In lieu of redesigning the inventory systems of these organizations to support a trajectory in line with their existing, diffuse inventory practices—our original intent and in line with a more typical user-centered design process—our future work turns, instead, to explore additional alternate currencies. Following calls for HCI researchers and designers to more explicitly embrace their political stances [43] as well as admonitions to consider when the implication is *not* to design [4], we believe that as the HCI and CSCW communities work to appropriate scholarship in the politics of measurement from disciplines such as STS and anthropology, it is our ethical obligation to foreground who is and who is not able to leverage these politics and to make clear our political stance through the research and design decisions that we choose. In our own work, then, we have chosen a trajectory for future work that will enable us to understand what new currencies, as critical forms of rhetorical power, might enable more systemic, sustainable change. In collaboration with our original community partner, instead of designing to support a cacophony of competing currencies, we look to identify new currencies that might more charismatically cut through the rest.

CONCLUSION

Research on inventory systems, more generally, tends to focus on issues of scheduling, loss of sales, and inventory control (e.g., [17, 32, 39, 61]). In the campus food pantries that we studied, these issues aren't at all predominant. Instead, we see multiple snapshots of data in a variety of units of measurement taken at different points in the workflow for different stakeholders. Far from being a database that simply keeps track of food coming and going, these assemblages of counting systems are tuned—down to their unit of measurement—to cater to stakeholders from different sectors with divergent goals and needs.

Most strikingly for these human services organizations, none of these currencies are tailored to measuring the mission-related outcomes of the organizations. Instead, these infrastructures of measurement are focused on sustaining the short-term needs of the organization: ensuring feedback to donors and other administrative stakeholders. These dominant interests, agendas and expectations all play significant roles in shaping the competing currencies of inventory infrastructures, resisting further processes of commensuration, and stymieing design.

Research in the politics of measurement emphasizes that the database is performative [10]. The categories and metrics instantiated in these powerful technical artifacts shape the ways that we see the world and, thereby, the possibilities for how we act in the world. They also shape the future of the organizations and institutions that we rely on to promote the public good and remedy social injustice. If the databases of human services organizations only serve the reporting interests of funders and other administrative stakeholders, they do so at the expense of supporting key aspects of their missions and those whom they serve.

In this research, we have shown that the importance of the politics of measurement in CSCW go beyond questions of deciding what should be measured and instantiated in information infrastructures. The politics of measurement stymie design at an even more mundane level—the *unit* of measurement. Different units of measurement afford fluid improvisations by those who work for food pantries as they attempt to navigate the multiple, conflicting expectations of donors, university administrators, volunteers, and clients. Instantiating different units of measurement in the design of information infrastructures, then, becomes a political act—a stance about who should be able to leverage the rhetorical power of charismatic currencies and about for whom those currencies should be wielded.

ACKNOWLEDGMENTS

REFERENCES

1. Alaimo, K., Olson, C. M., & Frongillo, Jr., E. A. (2001). Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. *Pediatrics 108*(1), 44–53.

2. Anderson, S. A. (1990). Core indicators of nutritional state for difficult-to-sample populations. *Journal of Nutrition 120*(11), 1559S–1600S.

3. Bardzell, S. (2010). Feminist HCI: Taking stock and outlining an agenda for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI 2010). New York: ACM Press, 1301–1310.

4. Baumer, E. P. S., & Silberman, M. S. (2011). When the implication is not to design (technology). In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11). New York: ACM Press, 2271–2274.

5. Benjamin, L. M., & Campbell, D. C. (2014, Spring). Programs aren't everything. *Stanford Social Innovation Review*, 42–47.

6. Berg, M. (1997). Of forms, containers, and the electronic medical record: Some tools for a sociology of the formal. *Science Technology Human Values 22*, 403–433.

7. Berry, J. M. (1984). *Feeding hungry people: Rulemaking in the food stamp program*. Brunswick, NJ: Rutgers University Press.

8. Bietz, M. J., Hayes, G. R., Morris, M. E., Patterson, H., & Stark, L. (2016). Creating meaning in a world of quantified selves. *IEEE Pervasive Computing 15*(2), 82–85.

9. Bietz, M., & Lee, C. (2009). Collaboration in metagenomics: Sequence databases and the organization of scientific work. In *Proceedings of the European Conference on Computer Supported Cooperative Work* (ECSCW '09). London: Springer, 243–262.

10. Bowker, G.C. (2000). Biodiversity datadiversity. *Social Studies of Science 30*, 643–683.

11. Bowker, G.C. (2006). *Memory practices in the sciences*. MIT Press.

12. Bowker, G.C., & Star, S.L. (2000). *Sorting things out: Classification and its consequences*. Cambridge, MA: MIT Press.

13. boyd, d., & Crawford, K. (2012). Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon. *Information, communication & society*, *15*(5), 662–679.

14. Bratteteig, T., Bødker, K., Dittrich, Y., Mogensen, P.H. & Simonsen, J. (2013). Methods in Participatory Design. In Jesper Simonsen and Toni Robertson (eds.). *Routledge International Handbook of Participatory Design*. New York: Routledge.

15. Cady, C. L. (2014). Food insecurity as a student issue. *Journal of College & Character 15*(4), 265–271.

16. Campbell, M. C. (2004). Building a common table: The role for planning in community food systems. *Journal of Planning Education and Research 23, 341–355*.

17. Çetinkaya, S., & Lee, C. Y. (2000). Stock replenishment and shipment scheduling for vendor-managed inventory systems. *Management Science 46*(2), 217–232.

18. Chaparro, P., Zaghloul, S., Holck, P., & Dobbs, J. (2009). Food insecurity prevalence among college

students at the University of Hawai'i Manoa. *Public Health Nutrition 12*(11), 2097–2103.

19. College and University Food Bank Alliance. (2013). *Our members*. Retrieved from: http://www.cufba.org/member-info/

20. Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Los Angeles: Sage Publications.

21. Cotugna, N., Glick, M., & Vickery, C. E. (1994). An outcome evaluation of a food bank program. *Journal of the American Dietetic Association 94*(8), 888–890.

22. Daponte, B. O., & Bad, S. (2006). How the private food assistance network evolved: Interactions between public and private responses to hunger. *Nonprofit and Voluntary Sector Quarterly 35*(4), 668–690.

23. DiSalvo, C., Lodato, T., Fries, L., Schechter, B., & Barnwell, T. (2011). The collective articulation of issues as design practice. *CoDesign 7*(3–4), 185–197.

24. Dombrowski, L., Brubaker, J. R., Hirano, S. H., Mazmanian, M., & Hayes, G. R. (2013). It takes a network to get dinner: Designing location-based systems to address local food needs. In *Proceedings of the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing* (UbiComp '13). New York: ACM Press, 519–528.

25. Dombrowski, L., Harmon, E., & Fox, S. (2016). Social justice-oriented interaction design: Outlining key design strategies and commitments." In *Proceedings of the ACM Conference on Designing Interactive Systems* (DIS '16). New York: ACM Press, 656–671.

26. Edwards, P., Jackson, S. J., Bowker, G. C., & Knobel, C. P. (2007). *Understanding infrastructure: Dynamics, tensions, and design*. Ann Arbor, MI: Deep Blue.

27. Espeland, W. N., & Stevens, M. L. (1998). Commensuration as a social process. *Annual Review of Sociology 24*(1), 313–343.

28. Espeland, W. N., & Stevens, M. L. (2008). A sociology of quantification. *European Journal of Sociology 49*(3), 401–436.

29. Freudenberg, N., Manzo, L., Jones, H., Kwan, A., Tsui, E., & Gagnon, M. (2011). *Food insecurity at CUNY: Results from a survey of CUNY undergraduate students*. Retrieved from: http://www.gc.cuny.edu/CUNY_GC/ media/CUNY-Graduate-Center/PDF/Centers/Center%20for%20Human%20Environments/cunyfoodinsecurity.pdf

30. Gaines, A. Robb, C. A., Knol, L. L., & Sickler, S. (2014). Examining the role of financial factors, resources and skills in predicting food security status among college students. *International Journal of Consumer Studies 38*(4), 374–383.

31. Gregory, J. (2000). *Sorcerer's apprentice: Creating the electronic health record, re-inventing medical records and patient care* (Doctoral dissertation, University of California, San Diego).

32. Ha, A. Y. (1997). Inventory rationing in a make-to-stock production system with several demand classes and lost sales. *Management Science 43*(8), 1093–1103.

33. Harmon, E. & Mazmanian, M. (2013). Stories of the smartphone in everyday discourse: conflict, tension & instability. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '13). New York: ACM Press, 1051–1060.

34. Haskins, R. & Baron, J. (2011). Building the connection between evidence and policy: The Obama evidence based initiatives. In R. Puttick (Ed.), *Using evidence to improve social policy and practice: Perspectives on how research and evidence can influence decision making* (pp. 25–51). Online at: https://www.nesta.org.uk/sites/default/files/using_evidence_to_improve_social_policy_ and_practice.pdf

35. Irani, L. C., & Silberman, M. (2013). Turkopticon: Interrupting worker invisibility in Amazon Mechanical Turk. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '13). New York: ACM Press, 611–620.

36. Irani, L., & Silberman, M. (2016). Stories we tell about labor: Turkopticon and the trouble with "design". In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '16). New York: ACM Press, 4573–4586.

37. Irwin, J. D., Ng, V. K., Rush, T. J., Nguyen, C., & He, M. (2007, January/February). Can food banks sustain nutrient requirements? A case study in Southwestern Ontario. *Canadian Journal of Public Health 98*(1), 17–20.

38. Jessri, M., Abedi, A., Wong, A., & Eslamian, G. (2014). Nutritional quality and price of food hampers distributed by a campus food bank: A Canadian experience. *Journal of Health, Population, and Nutrition 32*(2), 287–300.

39. Johnson, L. A., & Montgomery, D. C. (1974). *Operations research in production planning, scheduling, and inventory control (Vol. 6)*. New York: Wiley.

40. Jyoti, D. F., Frongillo, Jr., E. A., & Jones, S. J. (2005). Food insecurity affects school children's academic performance, weight gain, and social skills. *Journal of Nutrition 135*(12), 2831–2839.

41. Le Dantec, C. A., & Edwards, W. K. (2008). The view from the trenches: Organization, power, and technology at two nonprofit homeless outreach centers. In *Proceedings of the ACM conference on Computer supported cooperative work* (CSCW '08). New York: ACM Press, 589–598.

42. Liboiron, M. (2012). Terrible and charismatic waste. *Peabody Museum of Archaeology & Ethnology*.

43. Light, A. (2011). HCI as heterodoxy: Technologies of identity and the queering of interaction with computers. *Interacting with Computers 23*(5), 430–438.

44. Martin, A. & Lynch, M. (2009). Counting Things and People: The Practices and Politics of Counting. *Social Problems 56*(2), 243–266.

45. Merkel, C., Farooq, U., Xiao, L., Ganoe, C., Rosson, M. B., & Carroll, J. M. (2007). Managing technology use and learning in nonprofit community organizations: Methodological challenges and opportunities. In *Proceedings of the 2007 symposium on Computer human interaction for the management of information technology* (CHIMIT '07). New York: ACM Press, 8.

46. Miller, P. (2001). Governing by numbers: Why calculative practices matter. *Social Research 68*(2), 379–396.

47. Mol, A. (2002). Cutting Surgeons, Walking Patients: Some Complexities Involved in Comparing. In J. Law & A. Mol (Eds.), *Complexities: Social Studies of Knowledge Practices*. Durham, NC: Duke University Press, 218–257.

48. Monteiro, E., Pollock, N., Hanseth, O. & Williams, R. (2013). From artefacts to infrastructures. *Computer Supported Cooperative Work 22*(4–6), 575–607.

49. Nafus, D., & Sherman, J. (2014). This one does not go up to 11: The quantified self movement as an alternative big data practice. *International Journal of Communication 8*, 1784–1794.

50. Patton-Lopez, M. M., Lopez-Cevallos, D. F., Cancel-Tirado, D. I., & Vazquez, L. (2014). Prevalence and correlates of food insecurity among students attending a midsize rural university in Oregon. *Journal of Nutrition Education and Behavior 46*(3), 209–214.

51. Pine, K. H. & Liboiron, M. (2015). The politics of measurement and action. In *Proceedings of the ACM Conference on Human Factors in Computing Systems* (CHI '15), New York: ACM Press, 3147–3156.

52. Pine, K. H. & Mazmanian, M. (2014). Institutional logics of the EMR and the problem of 'perfect' but inaccurate accounts. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing* (CSCW '14). New York: ACM Press, 283–294.

53. Shklovski, I., Vertesi, J., Troshynski, E., & Dourish, P. (2009). The commodification of location: Dynamics of power in location-based systems. In *Proceedings of the 11th international conference on Ubiquitous computing* (UbiComp '09). New York: ACM Press, 11–20.

54. Snibbe, A. C. (2006, Fall). Drowning in data. *Stanford Social Innovation Review*, 38–45.

55. Star, S. L. & Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information. *Information Systems Research 7*(1), 111–134.

56. Strathern, M. (Ed.). (2000). *Audit cultures: Anthropological studies in accountability, ethics and the academy*. New York: Routledge.

57. Suchman, L. (1993). Do categories have politics? The language/action perspective reconsidered. In *Proceedings of the Third Conference on European Conference on Computer-Supported Cooperative Work* (ECSCW '93), 1–14.

58. Tarasuk, V. S. & Beaton, G. H. (1999). Household food insecurity and hunger among families using food banks. *Canadian Journal of Public Health 90*(2), 109–113.

59. Tarasuk, V. & Eakin, J. M. (2003). Charitable food assistance as symbolic gesture: An ethnographic study of food banks in Ontario. *Social Science & Medicine, 56*, 1505–1515.

60. Taylor, A. (2015). After interaction. *interactions 22*(5), 48–53.

61. Tersine, R. J. (1994). *Principles of inventory and materials management*. Englewood Cliffs, NJ: PTR Prentice Hall.

62. Troshynski, E., Lee, C., & Dourish, P. (2008). Accountabilities of presence: Reframing location-based systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '08). New York: ACM Press, 487–496.

63. United States Department of Agriculture. (2013). Food security in the U.S.: Key statistics and graphics. Online at: http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics.aspx

64. Voida, A., Harmon, E., & Al-Ani, B. (2011). Homebrew databases: Complexities of everyday information management in nonprofit organizations. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11). New York: ACM Press, 915–924.

65. West, H., & Green, G. (2008). Because Excel will mind me! The state of constituent data management in small nonprofit organizations. In *Proceedings of Americas Conference on Information Systems* (AMCIS '08), 336.

66. Winicki, J., & Jemison, K. (2003). Food insecurity and hunger in the kindergarten classroom: Its effects on learning and growth. *Contemporary Economic Policy 21*(2), 145–157.

67. Verran, H. (2010). Number as an inventive frontier in knowing and working Australia's water resources. *Anthropological Theory 10*(1–2), 171–178.

68. Williams, K. (2015). An anxious alliance. In *Proceedings of the Fifth Decennial Aarhus Conference on Critical Alternatives*. New York: ACM Press, 121–131