ON DESIGNING SHAREISH, AN OPEN-SOURCE, MAP-BASED, WEB PLATFORM TO FACILITATE DIVERSE SOLIDARITY PRACTICES

Adrien Guilliams
Dept. EE&CS, Montefiore Institute
University of Liège, Belgium

Florent Banneux
Haute École de la Province de Liège
Belgium

Ulysse Rubens
Dept. EE&CS, Montefiore Institute
University of Liège, Belgium
ORCID 0000-0001-9247-1974

Olivier Gason
Faculté des Sciences Sociales
University of Liège, Belgium
ORCID 0009-0000-0968-8727

Pierre Chapeau
Dept. EE&CS, Montefiore Institute
University of Liège, Belgium

Ogulcan Sevinç
Haute École de la Province de Liège
Belgium

Adrien Hoyoux
Haute École de la Province de Liège
Belgium

Christophe Lejeune
Faculté des Sciences Sociales
Faculté de Psychologie, Logopédie et
Sciences de l'Education, HEC
University of Liège, Belgium
ORCID 0000-0002-3622-7050

Raphaël Marée
Dept. EE&CS, Montefiore Institute
University of Liège, Belgium
ORCID 0000-0002-9587-1954

Abstract: *We present the Shareish web platform to foster diverse solidarity practices inspired by concepts of the gift economy. Its design is grounded in prior work (in CSCW and solidarity HCI), and in new qualitative research involving participants engaged in solidarity practices. Shareish aims at leveraging community assets through donations, free loans, requests of goods and services, free event announcements, and by enhancing the visibility of freely available resources. On a Shareish instance, users have the ability to view localized items on a map or in lists, utilize search filters, contribute new content with detailed textual and visual descriptions, engage in discussions with other users, and receive notifications when new content is added in their neighborhood. The platform can be replicated and improved by communities seeking autonomy as its source code is distributed freely under a permissive open source license (https://github.com/shareish). A research demonstration server is available (https://shareish.org).*

Keywords: *solidarity HCI, mutual aid, gift economy, online web application, free open-source software.*

INTRODUCTION

The modern era is facing worldwide population growth, resource depletion, unequal access to resources, extensive pollution, and significant waste across various sectors like food, textiles, and furniture. Moreover, it continually confronts substantial crises on a large scale, encompassing floods, conflicts, pandemics, storms, and economic crises or recession downturns. Diverse global and local endeavors are conducted to mitigate or restructure how we produce and consume (exemplified by initiatives like the "sharing economy," "circular economy," and "zero-waste" movements), alongside efforts to enhance citizen participation in decision-making processes.

The Sharing Economy and Alternative Networks

At the beginning of the 21st century, the emergence of digital technologies and of the Internet held the potential to facilitate collaboration among individuals and the shared utilization of their resources via the sharing economy (Schor & Vallas, 2021) where individuals grant each other temporary access to under-utilized physical assets (leveraging the "idling capacity"). It has been argued that the sharing economy could reduce overconsumption, better redistribute resources, and mitigate the continuous growth of climate emissions (Pérez-Pérez, Benito-Osorio, García-Moreno, & Martínez-Fernández, 2021). Indeed, similar objects to those that can be purchased new might be underutilized by neighbors who acquired them previously. Similarly, it is not uncommon for an organization to own a specific equipment that it under-utilizes while other organizations struggle to find such equipment for a one-time event. Likewise, this latter organization might have another equipment that could be beneficial for the former entity. In terms of food, stores or neighbors might have surpluses e.g. when the purchase or use of food does not go as planned, or when there is an abundance of personally grown fruits, plants, or vegetables. Technological artifacts or platforms from the sharing economy and smart cities concepts have then been promoted to optimize cooperation, co-use and reuse, of physical assets. However, scholars have argued the transformative potentials of these technologies should be questioned. More than ten years after the onset of the digital sharing economy (Miguel et al., 2022), it is obvious that social networks and such sharing platforms significantly ease the sale of (used) objects (e.g., via Facebook Marketplace or Vinted), the renting of physical assets (e.g. apartments through Airbnb or various tools through the Library of Things) or the access to various paid services (e.g. rent a scooter or taxi driver through Uber). Although these web platforms are undoubtedly useful for people who can afford to pay for sold items and services, these online tools do not profoundly change the way we produce, consume, and organize social relations. For example, according to a critical assessment of the sharing economy in Europe (Česnuitytė et al., 2022), food supply through existing ICT sharing platforms (e.g. to use food surplus) "hide from consumers negative outcomes such as precarious jobs, unfair labor practices, generating overconsumption, and hiding ecological externalities". In fact, many existing sharing platforms were not originally designed with equity or social justice in mind (McLaren & Agyeman, 2015), they promote commercial transactions (Belk, 2014), and the interactions facilitated by technical and design choices of these systems are claimed to be only a variant

of the market-based economy principles (Martin, 2016). These platforms have been very apt at "sharewashing" (Hawlitschek, Stofberg, Teubner, Tu, & Weinhardt, 2018) or adopting and exploiting the language of non-monetary practices by transforming these interactions into for-profit business.

Hence, alternative approaches and technologies that enhance the visibility and efficiency of sharing in fair and sustainable ways could be highly beneficial (Carroll & Bellotti, 2015; Light & Miskelly, 2019; Jiang & Marjanovic, 2021; Soch et al., 2022). Designers may find numerous off-line initiatives that try to address the aforementioned issues and to offer more inclusive alternatives to be of significant interest. Local exchange trading systems (LETS) and timebanks are networks of individuals willing to share local goods and services using alternative or complementary currencies (Seyfang & Longhurst, 2013; North, 2017). Such initiatives exist across various regions of the world. Although beneficial for participants, these initiatives still remain relatively niche, as they only involve a small portion of the population, and the general public is not well aware of the resources available. Potential free goods and services could remain entirely unnoticed by potential recipients and unshared by donors if these individuals are not engaged in these networks which may occasionally impose criteria for access. In an effort to improve this situation, online interactive systems have been designed to facilitate such exchange of goods and services, yet they come with various drawbacks and limitations. First, some of these online platforms may require subscription fees or target specific geographical audiences (e.g. a city or a country) because they are managed by a single entity (a company or organization) which has limited resources. Consequently, numerous communities are not the intended recipients of these platforms, leaving many individuals without the opportunity for easy exchange with others in their neighborhood. Moreover, these platforms often implement a "virtual currency" exchange system so that when a user offers an item (good or service) they can accumulate units of this currency which they can then use to barter, i.e. to later request a service or a good from others. However, such bartering (called "pseudo-sharing" by (Belk, 2014)) can potentially lead to exchanges motivated by accumulation and speculation hence somehow result in unequal access to resources, as goods and services are still exchanged for value received. Importantly, the use of a (virtual) currency might also sometimes dissuade people from participating. Since determining the value of a good or service is not straightforward and relies on many factors, this can complicate and limit exchanges. Furthermore, individuals may not always be aware of what they can offer in return. Therefore, bartering could dissuade especially those in need who currently lack anything to exchange. Furthermore, bartering or timebanking does not sound ethical nor desirable in acute crisis situations (such as a flood, war, pandemic, storm, economic crisis or recession,...), and one might argue quantifying and monetizing voluntary action somehow eliminates its autonomous aspects by denying to people the possibility to give altruistically (Wilson-Thomas, 2015) or by discouraging them from performing random acts of kindness (Bellotti, Carroll, & Han, 2013) which generally have positive impact for all involved parties (Curry et al., 2018; Kumar & Epley, 2023). It can also be argued these systems somehow maintain the societal status quo by not profoundly redefining work and value (Wilson-Thomas, 2021). Overall, current sharing economy platforms and alternative networks are insufficient alone to address social and environmental unsustainability and injustice.

Solidarity, Not Charity

Considering these limitations, many authors from diverse disciplines call for more fundamental changes in the form and structure of socio-ecological relations (Schmid, 2021). In essence, they argue that the societal organization of production, redistribution, consumption, and decision, should be further transformed. Numerous potential transformative and emancipatory concepts have indeed been proposed concerning environmental issues and solidarity among which post-capitalism, post-growth or degrowth, commoning, subsistence, pluriverse, community or care-based economies, real utopias, and prefigurative politics (Gorz, 1978; Mies, 1999; Gibson-Graham, 2008; Wright, 2012; Demaria & Kothari, 2017; Kothari, Salleh, Escobar, Demaria, & Acosta, 2019; Hakim, Chatzidakis, Littler, Rottenberg, & Segal, 2020; Schmid, 2021; Healy, Borowiak, Pavlovskaya, & Safri, 2021; Monticelli, 2022; Laurin-Lamothe, Legault, & Tremblay-Pepin, 2023). These currents of thought, among various proposals, suggest the importance of finding ways of creating alternative networks of value where relationships between individuals and groups are not characterized by profit but solidarity and interdependence. It includes non-market-based approaches to supply through local production and free exchange of goods and services (ie. without any monetary compensations). Interestingly, various utopian imaginaries of universal solidarity have also been sketched by various authors: a community-owned "general catalog" (Saros, 2014) of free products and services, an infrastructure supporting a decentralized non-monetary economy in a post-market society (Fuchs, 2020), a "digital feedback infrastructure" implementing solidarity-based processes to match problem-finders and problem-solvers outside of the commercial realm (Morozov, 2019), a working prototype of a "civic platform" to combine both efficiency and solidarity (Muldoon, 2022a), a digital tool for community sharing and alternative neighborhood plans (p.m., 2009), ... While one could argue some of these ideas sound idealistic and lack pragmatism, diverse solidarity practices have actually spanned the ages (Kropotkin, 1902; Mauss, 1954; Sahlins, 1974; Cheal, 1988; Graeber, 2012; Vaughan, 2021). Although cooperation practices among strangers have been hypothesized to have declined over the last decades (attributed to a global decrease in social bonds), there are reasons to remain optimistic (Yuan et al., 2022; Zhou & Dong, 2023), and utopian imaginings somehow underlie thinkings of several participants of sharing platforms (Fitzmaurice et al., 2018; Schor, 2021). Moreover, recent tragic events (such as a flood, war, pandemic, storm, economic crisis or recession, ...) have also reminded us, on the one hand, that many people are vulnerable and require unconditional help. On the other hand, the impulses of solidarity can be numerous but efficient organization of solidarity actions is essential (Travlou, 2021; Mao, Fernandes-Jesus, Ntontis, & Drury, 2021). Research studies actually reveal a series of complementary solidarity concepts, exchange structures, and practices (Nowak & Sigmund, 2005; Bolton, Katok, & Ockenfels, 2005; Trivers, 2006; Moody, 2008; Herne, Lappalainen, & Kestilä-Kekkonen, 2013; Yoeli, Hoffman, Rand, & Nowak, 2013; Apeldoorn & Schram, 2016; Curry et al., 2018; Okada, 2020; Yuan et al. 2022; Zhou & Dong, 2023) named as gift economy, mutual aid, non-monetary sharing, network-generalized exchange, self-help, indirect reciprocity, third party or reciprocal altruism, or random acts of kindness. Mutual aid ("*solidarity, not charity*" (Spade, 2020)) and gifting are ancient practices in the history of humanity which have persisted to varying degrees through the ages (Benveniste, 1969). When gifting, one does not negotiate an immediate return. Gifting or generalized reciprocity

is the exchange of goods and services without keeping track of their exact value, with low obligation to reciprocate (with an eventual, implicit, expectation that their value will somehow balance out over time) or no obligation to reciprocate whatsoever. While in bartering or in direct reciprocity, parties directly exchange resources with each other (two actors A and B give benefits to each other in a relation of direct reciprocity: A gives to B, and B gives to A), indirect generalized exchange involves more than two parties: One actor A gives benefits to another B and eventually receives benefits from a third party (C or D or ...) (Molm, Collett, & Schaefer, 2007). Such generalized indirect exchanges are used for community cohesion through structuring social reciprocity, and they leverage community assets. Mutual aid has been a longstanding practice among communities who experience short-term and long-term crisis, and it is considered as a humanizing approach to care and a compassionate act based on shared humanity (Littman et al., 2022), based on the assumption we all have both needs and something to offer (one's role can shift from giver to receiver, or vice versa).

Nowadays, these longstanding conceptions of solidarity are continued or reinvented and materialized in different forms and places, including face-to-face interpersonal free exchanges (Lampinen, 2021); groups to support vulnerable individuals and offering free assistance (mutual aid (Spade, 2020), "*caremongering*" (Seow et al., 2021; Bishop et al., 2022)); stooping or curb alerts (the action of taking something off the stoop, or curb, that was left there for others to take, potentially with no in-person contact); gleaning (the humanitarian act (Badio, 2009) of letting people collect leftover crops from fields after they have been mechanically harvested (Marshman & Scott, 2019)); food growing in public spaces for public consumption (Farrier, Dooris, & Morley, 2019); give boxes and free shops (freely accessible places where everyone, without any access criteria, can come to deposit and acquire items), "*donnerie*" or "*gratiferia*" (free markets taking place on a specific date), grassroots food sharing networks to reduce food insecurity and food waste through the transformation of surplus food from a commodity to a gift (Berns & Rossitto, 2019); community and solidarity fridges (somehow similar to "give boxes", but for food (Zain, 2023; Chies, 2017)); repair cafés (free events where people can bring in broken or damaged items to be repaired by volunteers, (Moalem & Mosgaard, 2021; Schägg, Becker, & Pradhan, 2022)); or even free little art galleries (Jones, Nousir, Everrett, & Nabil, 2023b). In this paper, our aim is to better understand the social environment and how Shareish, a technological platform under development, can facilitate and nurture these diverse solidarity practices.

Main Limitations of Current Software Technologies to Foster Solidarity

Design decisions made by technological platforms (including social networks and digital maps) can have immense impacts on how we experience our neighborhood and our world. They shape our understanding of it and of our place within it (Graham, 2022). While mainstream technological platforms mainly highlight for-profit entities and ease commercial transactions, digital tools can alternatively support logics of reciprocity (Schor & Vallas, 2021) and solidarity can be triggered from online spaces to offline communities (Zhou & Dong, 2023). Recently, some features of the popular social media platforms (e.g. Facebook groups or Google Sheets) have actually been extensively used for mutual aid and care in

acute crisis situations (Knearem, Jeongwon, Chun-Hua & Carroll, 2021; Seow et al., 2021; Travlou, 2021; Wilson, Roskill, & Mahr 2022; Zhou & Dong, 2023). While their use was instrumental by contributing to fill gaps in essential supplies and services left unfilled by the State, these platforms have several drawbacks. First, their design often leads to time-consuming and laborious work (e.g. scrolling through a group's Facebook timeline to find aid requester's or providers' posts, Knearem et al., 2021). Moreover, aforementioned commercial platforms (and others, such as Nextdoor) create individual and collective tensions including political conflictuality and practical powerlessness (Rossitto et al., 2021; Masden et al., 2014; Payne, 2017). Political tensions include the fact the platforms that underlie so much of our daily lives and social interactions are controlled by a small group of owners who remain largely unaccountable for their decisions (Lynch, 2019; Forestal, 2022; Muldoon, 2022b). Practical powerlessness can result from the fact that their source code is proprietary (not accessible), so these platforms can not be finely community-controlled but only managed by an external entity. In practice, proprietary platforms cannot be easily scrutinized or extended by their actual users (or by HCI researchers) to fit their specific needs. For example, it is not well-known how posts in a Facebook group's feed are ordered, and neither software developers nor aid providers can change this ordering according to practical considerations. Pragmatic design tensions (Rossitto et al., 2021) also encompass the absence of guarantee an existing, useful, feature will remain available or affordable. In practice, it is not uncommon that a single entity managing a dedicated platform decides to discontinue it, or to reorient its objectives or features for commercial reasons. For example, the *Jaspr Trades* for "cash-free swap community in Berlin" (https://www.instagram.com/jasprtrades/) suddenly ended its activity, the renting platform *Usitoo* in Belgium did not find a sustainable business model and was discontinued (https://end.usitoo.be/), the *Kassi* online forum "with the aim of linking those who can give something to those who are in need" (Lampinen, 2021) became as a start-up company the "*Sharetribe* online marketplace to sell, buy, and lend stuff", the *Geev* platform (https://www.geev.com/) started to implement commercial ads then premium features that restrict which free items non-subscribed users can see, a decision followed by several comments of unsatisfied users feeling pushed out of the application by increasingly aggressive monetization practices. In contrast to such closed-source, proprietary, software licensing carried out by most sharing platform companies, open-source distribution means the whole recipe of a software platform (its source code) will remain available and readable by third-parties, so the suite of operations behind each software feature can be scrutinized. Moreover, a free open source license permits third-parties to modify, use, and redistribute the software for any purpose, based on the notion of "common humanity" (through the mutual dissemination of knowledge and the acknowledgment of the abilities of each individual to act and to do) (Boltanski & Thévenot, 2006; Depoorter, 2020). Therefore, it potentially allows its reuse by various communities (including less-resourced grassroots groups) and the seamless launch of bottom up, self-organized, initiatives rooted in daily lives. Open-source technologies for sharing could also be good candidates to contribute to the emergence of communities (Abou Amsha, Gronvall, & Saad-Sulonen, 2023), they could favor processes of proliferation (Larsen-Ledet et al., 2022) and help to resist to the influence of the growth discourse of corporations, towards local caring arrangements where citizens are empowered, as exemplified by the collective experiences of technological sovereignty, grassroots digital urbanism, or civic tech grassroots (March, 2018; Lynch, 2019; Vadiati, 2022; Knutas et al.,

2022). Overall, they are expected to increase human autonomy by enabling the creation of tools for conviviality (Illich, 1973) and autonomous spaces adapted to local conditions that are not subjected to a centralized control, hence reclaiming a greater human dignity (Keyes, Hoy, & Drouhard, 2019; Swann, 2022).

Moreover, existing platforms are also not (or only weakly) exploiting geolocalizations whereas community maps can better raise consciousness and produce forms of empowerment (Parker, 2006; Buoli, 2014). In practice, using current platforms, it is not easy to discover local free ressources and to be aware of solidarity actions in one's immediate surroundings. While access to earlier geographic information systems was a concern (Sieber, 2006; Craig, Harris, & Weiner, 2002), modern online maps are now often considered as an ideal interactive, mobile, and collaborative interface between a human, groups of people and the dynamically evolving environment (Kraak & Fabrikant, 2017). Online maps enable users to better engage with reality (Hiltz et al., 2020; Auferbauer & Tellioğlu, 2017) for emergency/disaster management where it is suggested data should be displayed by geographic location on maps in relation to the user's current position, rather than as item lists (e.g. posts on a Facebook Group's feed). Similarly for gleaning, (Badio, 2009) suggests mapping services are vital to long-term success as digital maps can help to coordinate multi-actor initiatives and to share knowledge. Geographical proximity is also viewed as a critical factor for those who participate in sharing (Fors & Ringenson, 2023), and maps can be used in various ways to enable civic participation in urban environments (Yu & Cai, 2009; Tzanidou & Vlachokyriakos, 2022). Several human geographers and philosophers have also pointed out the potentials of maps (seen as platforms for locally situated knowledge) e.g with concepts of maputopias (Gutierrez, 2018), caretographies (Hind, 2017), and transformative or radical cartography (Cohen & Duggan, 2021). These works suggest ordinary citizens can collaboratively generate maps to produce an alternative, dynamic, useful, community-owned representation of a territory in order to open avenues of social transformations previously held inaccessible or invisible (Denil, 2011), or to chart new desires and hopes for a better future into the landscape (Firth, 2014). The map of the visible represents the realm of possibilities and prepares us for action (Zwer & Rekacewicz, 2021). Maps are considered as tools that can be made and used with the aim of transforming territories and landscapes according to social projects, they contribute to shaping territories and not only represent them passively (Besse, 2023), they have the potentials to construct new propositions about how the world is represented and organized (Graham, 2022). After all, technological tools and digital maps are massively used by citizens e.g. to localize and use bikes or electric scooters in large cities, so there is no technical reason that this cannot be the case to easily access other free resources while promoting solidarity and reuse.

This Work: Understanding and Facilitating Diverse solidarity Practices Through Online Community Mapping and Open-Source Practice

Given all these limitations on the one hand, but also all the unexplored potentials on the other hand, the work we present in this article is in line with various HCI works that have suggested that novel sociotechnical tools could be created to experiment the move from a market logic to the co-creation of human economies (Vlachokyriakos et al., 2017), in other

words toward advancing sustainable, just, and humane futures (Sharma, Kumar, & Nardi, 2023).

The following sections expose the results from new qualitative investigations of local solidarity practices and present the extended design of Shareish ("Share and Cherish") (Guilliams, 2023), a modern, map-based, web platform dedicated to people driven by mutual trust, comradeship, and generosity and refusing to measure and remember who had given what to whom, with the long-term goal to increase random acts of kindness and more broadly solidarity practices at the street corner or beyond. This platform is centered around an interactive, user-editable, digital map, advanced search functions, and communication modules that can be easily deployed to foster diverse solidarity practices. While (Guilliams, 2023) was mostly focusing on generalized (face-to-face) exchange of geolocated goods and services, here we first took efforts to better understand the social environment where Shareish could grow with the help of local actors of solidarity communities to learn from their creativity and experiences. Software-wise, our extended version offers functionalities that are in line with a greater diversity of locally situated solidarity practices, and new user interfaces. As the previous software version, the extended version of the whole system is distributed under an open-source permissive license as a gift to the society, and to foster further developments by communities, CSCW, and Solidarity HCI developers. From a computer science perspective, the Shareish platform is at the intersection of human-centered informatics and solidarity HCI, modern web/software development, digital mapping, spatial database design, and container technologies. In addition, Shareish exploits recent research in artificial intelligence to ease user experience. Limitations of this work and design opportunities will be discussed before we conclude.

DESIGN METHODOLOGY

Establishing Platform Requirements Through Literature Review, Online Ethnographic Observations, and Qualitative Research

Designing an online platform for ICT-mediated solidarity practices necessitated learning about the diversity of practices (see e.g., Figure 1) as well as the needs and problems of the intended users. To this end, we extended the design methodology described in (Guilliams, 2023) and relied on additional data sources and initiatives. We expose below our design methodology into three main complementary approaches.

First, we extended our literature review of research papers related to solidarity practices in a more broader sense. We carried out a thorough analysis of papers describing mutual aid groups created during the COVID-19 pandemic with tens of thousands of requests/aids (Knearem et al., 2021; Seow et al. 2021; Travlou 2021; Wilson et al., 2022; Zhou & Dong, 2023); papers that have retrospectively analyzed thousands of transactions in Timebanks or online forums for local communities (Collom, 2012; Kyungsik, Shih, Bellotti, & Carroll, 2015; Glückler & Hoffmann, 2021; López & Farzan, 2015); papers describing gleaning (Badio, 2009; Marschman & Scott, 2019) and solidarity fridges initiatives (Chies, 2017; Zain, 2023; Kiden, Strohmayer, & Yee, 2023); previous C&T, CSCW, and HCI research works that relates to the design of community/sharing platforms in a human-centered way

(Suhonen, Lampinen, Cheshire, & Antin, 2010; Feng, Li, & Li, 2013; Bellotti et al., 2013; Bellotti et al., 2015; Yu & Cai, 2009; Luckner, Fitzpatrick, Werner, & Subasi, 2015; Light & Miskelly, 2015; Lampinen et al., 2017; Dillahunt et al., 2017; Lampinen, 2021; Fedosov, Albano, & Langheinrich, 2018; Hiltz et al., 2020; Fedosov, Cheok, & Huang, 2021; Knearem et al., 2021; Fedosov, Lampinen, Odom, & Huang, 2021; Ntouros, Kouki, & Vlachokyriakos, 2021; Jones, Nousir, Everrett, & Nabil, 2023a; Fors & Ringenson, 2023; Fedosov, Zavolokina, Krumhard, & Huang, 2023) and whose authors have derived design guidelines and opportunities (through case studies, interviews, and participatory design workshops).

Second, we performed additional online ethnographic observations involving several groups and platforms related to gifting and solidarity. These punctual observations include four french speaking Belgian Facebook groups centered about gifting between users (including a city-wide "gifting" group with more than 40K users from which we sampled 200 posts over a period of three months in 2022); two Facebook groups about gleaning (where farmers or individuals announced the location of fields where gleaning was possible, September-October 2023, Wallonia, Belgium); data from a specific, closed-source, web platform (https://aide-inondations.be/) created following a major flood (100 random posts randomly sampled over a period of one month following the tragic event in summer 2021, Liège, Belgium); Instagram profiles for stooping (we found more than 100 worldwide profiles, with groups that can range from a few dozen users to several hundred thousands, autumn 2023); Instagram profiles and Facebook pages for community fridges (in US cities and in Liège, Belgium, autumn 2023); and user comments about the *Geev* App for donating items between individuals (https://play.google.com/store/apps/details?id=fr.geev.application). We also observed *Vinted* (https://vinted.com/, a commercial platform for secondhand items), *Facebook Marketplace* (https://www.facebook.com/marketplace), *Mytroc* https://mytroc.fr (a LETS platform using a virtual currency), and on https://www.freecycle.org/ (a bulletin board for donations and requests). Furthermore, we analyzed *SolidarityCityMap* (https://solidary.city/) and *Priceless* (https://priceless.zottelig.ch/), two maps that show places where people can participate in city life without papers or money; as well as two applications to update *OpenStreetMap* database content (https://www.openstreetmap.org/, the free editable map of the world): *StreetComplete* (https://streetcomplete.app/) and *MapComplete* (https://mapcomplete.osm.be/).

Third, to better understand how people demonstrate solidarity and to explore the environment where Shareish intends to insert itself, we conducted a qualitative study on mutual aid and giving practices, described in the following subsection.

Figure 1. Illustration of some solidarity practices in Belgium. From left to right: dishes on a window sill in Liège (stooping), public bookcase in Champion-la-Famenne, storefront of a free clothes shop in Ghent, solidarity fridge in a street in Liège, table with toys for children in a free market event in Ans, a give box for small objects in Saint-Nicolas. Images by Researcher.

Understanding Diverse Needs, Interests, and Values from Local Actors

For this research, we met people from different initiatives in Belgium, selected according to their diversity. In the region of La Louvière, a local Facebook Group allows members to post offers or needs for peer-to-peer gifting while also hosting a physical shop offering clothes and other small items for free. In the region of Ghent, we visited a free clothing shop hosted in a long-term squat with a storefront in a commercial street. In the region of Liège, we participated in a free market ("donnerie") organized in a local cultural center. We also conducted on-site observations of events dedicated to giving; we occasionally conducted qualitative interviews with organizers of these events and volunteers. All names that follow have been pseudo anonymised.

Our observations and interviews guides were oriented towards the understandings of participants. Our interests and questions were not bounded to their gifting practices and behaviors but also explored related values, purposes or beliefs. We also questioned the current uses of digital technologies (such as social media) and the dispositions to adopt alternate digital tools (such as Shareish).

A trace of each observation was kept by writing field notes; each interview was audio recorded and transcribed. The resulting field notes and interview transcripts were shared among co-authors thanks to Cassandre, a collaborative platform dedicated to qualitative team research (Lejeune, 2011). As soon as it was available, each piece of empirical material was coded, by one researcher at once, either by the one who collected it or by a different team member. At least three team members discussed each code candidates in order to improve it. Grounded Theory Method (Charmaz, 2006; Lejeune, 2019) furnished the principles governing these enhancements. Codes eliciting the participants subjective experience were preferred to thematic coding. Broad or all-encompassing codes were thus avoided in favor of codes eliciting the specificity of each context or situation. Of course, our discussions were also guided by the practical purposes of the study (design).

Discussions about codes eventually raised questions to be addressed during the next field contact. In an iterative design, observation/interview guides were thus different for each contact (which ensures fieldwork productivity).

Sense of Community

We found that maintaining a free shop requires a substantial investment of labor and resources. This work is performed by volunteers who dedicate their time to greet visitors and maintain the store's cleanliness and organization (Ghent, 02/2024). Similarly, online communities require considerable work to moderate their space and help users struggling to understand how the group functions (La Louvière, 01/2024).

While a significant number of group users or free shop visitors are occasional or even one-time participants, regular involvement in a giveaway initiative can foster a deep sense of community and belonging among its long-standing members (La Louvière, 01/2024). These communities weave a complex network where the skills and resources of every volunteer and elements of their environments make each initiative unique. *"The shape of the shop has been completely determined by the people working in it. It's [made with] a unique group of people and the context of the neighborhood and everything."* (Hugo, Ghent, 14/02/2024). In Ghent, we learned about the history of the neighborhood where the squat is located and its impact on the shop's identity. The street was previously an important commercial street of the area and it is acting as a facilitator that made the shop more inviting for curious older residents. Similarly, online groups can become a place to advertise local events or even for some participants to simply write greetings to others (La Louvière, 01/2024; Online observations 12/2023).

Rules

This uniqueness extends to the rules, formal and informal, that each store creates. Free stores (Ghent, 02/2024), giveaway events (Ans, 11/2023), and Facebook groups (Online observations 12/2023) all require their users to follow certain explicit or implicit rules to be able to function. These rules vary greatly with regards to volunteers maintaining it, their participants, and even acting entities such as their location or their infrastructure. These rules and know-how need to be learned by users so that the group or store can function and a sudden influx of new users is hard to manage. *"Like I think sort of comparing it to being [in a] city center. If [we were,] we would be engulfed by people that have no connection to any kind of community or social behavior every week it would be very difficult."* (Willem, Ghent, 14/02/2024).

These rules can be minimal or regulate conditions for the gift or the future usage of items. When organizers of a store decide that items going through their free shop must not be sold, they track users online and in person to make sure they intend to use the gift they intend to take. When there is a doubt on the intent of the receiver, volunteer organizers can search online for the item being resold. If caught, the contravener would then be banned from the community (La Louvière, 01/2024). In physical free stores, organizers can also investigate the users interested in taking an item seen as valuable with questions to test their intents (La Louvière, 01/2024). Other initiatives consider that the destination of the gift is out of their scope. For Hugo (Ghent, 02/2024), gift, movement, and flow prevail over the intentions of the recipients and if someone finds a way to earn money from their clothes they probably need it anyway. Some forms of giveaway can also mandate a donation to take part. In a giveaway event in Ans (11/2013), organizers chose to ask each visitor to bring at least an item to be given in exchange for a ticket used to leave the event with up to ten gifts. The gift

brought was not expected to be proportional to the item taken. When asked, the organizers explained that this rule was put in place to avoid the feeling of charity for its visitors.

Roles and Meanings

Such practices might seem at odds with some of the driving principles behind the gift economy but reflect that gifts can take on multiple meanings for each participant involved, or even multiple meanings at the same time. The meanings of solidarity practice can be deeply rooted in the anarchist currents of thought (e.g. Kropotkin, 1902) but can also be seen as an ecological act of fighting against overconsumption or a simple act of solidarity for those who need it and might be in dire circumstances. Teaching these meanings to visitors or users helps them go past initial resistances. Some of these resistances might be that the gifts should be left to only the most needy or that there would be an inherent dirtiness to used items (La Louvière, 01/2024). We saw that a free shop can achieve this aim through accessibility, regularity, and a welcoming atmosphere (Ghent, 02/2024).

For a giveaway platform to last, the collaboration of both event organizers and individual sharers and receivers of gifts is needed. Those two profiles are not distinct in practice and overlap greatly but can be used to highlight some of the different interests we have identified so far. Regular users of the gift economy play different and often multiple roles in free exchange. While sorting received donations in their free shop, actors discuss their last donation while boasting that everything they wear came from the free shop (La Louvière, 01/2024). On the other hand, when looking at the reported size of some Facebook groups and the history of their users, it appears that offering a gift or making a single request and then stopping their participation in those groups is a regular occurrence (online observation, 12/2023).

For an organizer of an event or free shop, using a new platform to advertise their initiative is not particularly labor-intensive but advertising an individual offer on a new platform represents a greater amount of work. To create a receivable gift offer on a Facebook group, a user needs to understand and provide the minimum information required. If some information is missing or generates multiple comments to request the missing information, a post might be received with hostility or won't be approved by the moderator. These expected pieces of information can be factual and practical like the nature and location of the gift or the need but it can also include the expectation of a "hello" or a "please" (La Louvière, 01/2024). Users need to learn to take pictures showing their offering in its best light and include all necessary information in the post to avoid misunderstandings. This process takes a considerable amount of time and can be an obstacle to the participation of some less technologically inclined users. A group can also facilitate this process by working as a free store and receiving gifts for which donors do not want to take the time to post them online (La Louvière, 01/2024). This also highlights the complexities of building an efficient post-creation process as the complexity is highly dependent on the user. In online communities, when some less technologically inclined users with good intent struggle to craft a post following the expected standard of an online community, some more experienced users might contact them and help them (La Louvière, 01/2024).

To work day-to-day, each free shop needs to maintain a careful balance, gifts come in by the bag and items come out in much smaller numbers. This balance is created and maintained by the constant filtering and sorting of organizers. In the case of gifted clothing, the supply

can often appear never ending for both projects and the act of filtering what is worth keeping is an important operation of the day-to-day gift economy. To be a good sorter, volunteers need to be very selective to make sure their limited storage is not filled with objects no one wants. Volunteers need to balance the need for a stock that will be desirable and prioritize less often received items such as male clothing or scarcer sizing (Ghent, 02/2024).

Matters of Fairness

When several users are interested in the same gift offered through an online platform, users are in effect in competition for who will receive the gift. In such a situation, it is easy to feel disadvantaged against those who are more regularly connected on the platform. To address this difficulty, some groups mandate a three-day waiting period on any offer before the giver can choose the receiver of their choice (La Louvière, 01/2024). These efforts reveal how organizers aim to provide an equal opportunity for each to use the platform but some users try to circumvent them by sending private messages directly to the giver and offering money for the item (La Louvière, 01/2024). When no feeling of competition is felt, users and organizers rely on the large supply of gifts to fulfill the needs of visitors (Ghent, 02/2024). Even when it is not explicitly forbidden, introducing money in a free exchange can be seen as unfair or hurtful to actors. While a donation box might exist for convenience, it is much preferred to contribute your time, gifts, or resources directly (Ghent, 02/2024).

Matters of Mobility

For online communities of givers, an important concern lies in the mobility of the gift. When users do not own or do not wish to operate a car, any movement to and from the gift location can be costly in time and effort. The availability of a car or access to public transportation is an issue for givers and receivers, as for organizers. Some online communities have begun to organize storage and a network of relays throughout their region (La Louvière, 01/2024). Here, the system relies on the gift being dropped in the free shop associated with the group and then stored in a dedicated box labeled with its intended destination. Regular users were willing to act as relays and to pick up and store these gifts at their homes for their receiver to schedule a pickup. Even though it is uncommon or banned in the community rules, traveling to deliver a gift can also be accepted as long as the receiver could not reasonably be expected to due, for example, to their age, health, or living condition (La Louvière, 01/2024). When gifters or receivers do not show up to a scheduled appointment or if the involvement of one of them is perceived as insufficient, a user can be sanctioned by the community through a message, a bad reputation, or even a ban from the platform (La Louvière, 01/2024).

SHAREISH PLATFORM

The first version of the Shareish platform and its iterative design, development, and development cycle were described in (Guilliams, 2023). Since then, design requirements were refined following the extended design methodology described in the previous Section. Here, we first summarize the general, updated, design requirements. These requirements are then translated into software functionalities, and then into their technical implementation (available in the form of an open-source software). Limits and additional design opportunities are later discussed.

Summary of Design Requirements

Our extended design methodology allowed us to derive the following requirements:

1. *Usability and ease of access*: The platform should be accessible on both personal computers and mobile phones (Fedosov et al., 2018), take into account the community diversity (incl. multilingualism); provide various hints and helping functions. Platform access should comply with community perception of fairness.

2. *Locally situated*: the platform should provide a strong connection to geographic location to foster a sense of community within a hyperlocal environment (Suhonen, Lampinen, Cheshire, & Antin, 2010) and allow participants to discover and mobilize resources from their immediate surroundings (López & Farzan, 2015; Fors & Ringenson, 2023), while taking into account people's ever-changing location (Bellotti et al., 2013) and residential instability (López, Farzan, & Lin, 2017), so without rigid assignment of users to a neighborhood (Masden et al., 2014; Payne, 2017). An online interactive map is considered the most useful tool to find shared objects and public resources within or beyond users' immediate neighborhood (Fedosov et al., 2021), and it is strongly advised for managing tasks in emergency situations (Auferbauer & Tellioğlu, 2017; Hiltz et al., 2020). The digital map should allow individuals to encode specific locations (with geocoded address names or precise GPS coordinates) as exchanges processes and places can be in various forms within a community, e.g. a street address for interpersonal face-to-face exchange at home or at another safe place; a field for gleaning; or various physical intermediaries such as a free shop or a shared space in a building (Lampinen et al. 2017; Zhou & Dong, 2023); a curb, a public bookcase or a give box (for indirect exchange with no in-person contact).

3. *Solidarity through diverse practices*: The platform should allow individuals or groups to undertake various forms of solidarity actions (ranging from face-to-face to no in-person exchanges) in order to satisfy basic needs first (Bellotti et al., 2015) while also mitigating their potential feeling of indebtedness (Lampinen, 2021). The platform should make it just as easy to offer, lend (for free), ask for help, add free events, or add public free resources, so that individuals or entities can get involved spontaneously in different ways and switch between roles and create value together (Carroll & Bellotti, 2015). To allow wide participation across a community, it should provide open access to basic, freely available tangible goods, services, and events. According to previous studies (Knearem et al., 2021; Seow et al., 2021; Travlou, 2021; Mao et al., 2021; Wilson et al., 2022; Collom, 2012; Han et al., 2015; Glückler & Hoffmann, 2021; López & Farzan, 2015) and to our observations, users should be able to offer/seek a wide variety of time-sensitive items (goods services) e.g. (cooked or raw) food, clothes and blankets, pick-up of essential materials, drop off of groceries, transportation to medical appointments, HVAC equipments (air conditioners, dehumidifiers, heating systems), helping hands for a move or cleaning, assistance with administrative tasks; as well as announcing free activities.

4. *Fine-grained content information*: Providers (resp. receivers) should be able to precisely describe a great variety of goods and services they are providing (resp. seeking) rather than only through generic categories that are insufficient in the details they convey (Fedosov et al., 2021), including the possibility to associate multiple

images to describe items. Clear time limits must be definable to minimize efforts required to manage posted content (Lampinen et al., 2017).

5. *Efficient user content creation*: The platform should provide various auto-completion mechanisms to help users to easily add structured content (Knearem et al., 2021; Fedosov et al., 2021) in order to create active-enough streams of content (López et al., 2017). This might be facilitated by the reappropriation of emerging AI recognition technologies (Teli, Lewkowicz, Rossitto, & Bødker, 2021).

6. *Efficient content search and scalability*: The platform should provide different ways for searching and visualizing items based on their location and various filtering and ordering criteria exploiting their rich descriptions, rather than laborious scrolling through an infinite list of posts without any control on how items are presented (Knearem et al., 2021).

7. *Continuous perception of activity*: The platform should provide users information about site activity for building a sense of social presence (Suhonen et al., 2010) using mechanisms to display site usage, and configurable proximity notifications that indicate activity in the neighborhood (e.g. instantly when someone encounters an unexpected need (Bellotti et al., 2014) or posts a new offer; or only daily/weekly notifications) (Fedosov et al., 2021).

8. *Building user trust*: The platform should provide mechanisms to build interpersonal trust between users involved in face-to-face exchanges, e.g. to allow intuitive communications between users and progressive self-disclosure to accentuate common interests between users (e.g. using profile with/without name and possibly multiple pictures, with precise/approximate location, and through asynchronous or real-time private and public dialogue) (Feng et al., 2013; Fedosov et al., 2018; Pan, Feng, Wingate, & Li, 2020; Knearem et al., 2021; Lampinen, 2021; Fedosov et al., 2023).

9. *Transparent data processing and privacy*: The platform should provide ways to scrutinize how user's data are handled to improve trust (Scholz, 2016; Masden et al. 2014), and allow parametrization of notifications, unwanted message blocking, as well as allow users to disable or delete their account.

10. *IT Management*: The platform should ease day-to-day organization (Luckner et al., 2015) including modules for system administration (installation, maintenance, backup), content curation, and data extraction. The platform should be easy to replicate so it can be reused and adapted for different places and communities (Sieber 2006; Lampinen, Rossitto, & Gradin Franzén, 2019; Larsen-Ledet et al., 2022).

Main Functionalities

Shareish functionalities fulfill aforementioned design requirements. On a deployed Shareish server, users (individuals or entities) can indicate they want to either give (Donation), loan (Loan), or ask for (Request) items or services, as well as announce Events. In addition, they can add or edit public resources (such as public bookcases, give boxes, …) and associate donations/requests to them (so as to use them as physical intermediaries). Adding content can be done directly by adding a marker on the map, or through a form page. Users can also easily discover what other users have to offer or what they request [Reqt 3], using various interactive mechanisms (a map [Reqt 2] and a browsable list with advanced filters [Reqt 6],

configurable notifications of new content [Reqt 7], and textual private conversations or public comments [Reqt 8]). Shareish user interfaces have been designed to make it easy to adapt to other languages (internationalization) [Reqt 1], and it is currently available in English and French.

Users

A Shareish user can be a provider or a receiver [Reqt 3] and create various types of content at various places [Reqt 2]. In our data model, a *user* is typically an individual acting on his behalf (but it might be a representative of an organization) to which a unique e-mail address has to be associated to register on the platform. In addition, the user can provide an additional textual description and links to other social networks, as well as several profile pictures [Reqt 8]. In their profile, users can also indicate a reference address [Reqt 2] that can be used to get *notifications* (instantly, daily, weekly, monthly, or never) by e-mail when new content (items, events, public resources) is published [Reqt 7] in a configurable neighborhood (based on the *distance* as the crow flies [Reqt 2]). Users can enable or disable the recording of the items they see on the platform (to be able, or not, to filter them), and they can temporarily disable or definitely delete their account [Reqt 9]. If individuals do not want to register on the platform, they have the possibility to view a map with public resources only and limited functionalities (other users' personal items are not displayed and direct interaction with them is not possible).

Items and Free Public Resources

A user can add or search content on the platform. Each piece of user-contributed, semi-permanent, content is called an *item* and it can be either a good (e.g. a mower to lent or to give), a service (e.g. to mow your lawn), or an event (e.g. a free Repair café, an assembly meeting) [Reqt 3]. More precisely, when a user adds an item, they have to choose an *item title*, an *item type* (Donation, Loan, Request, Event), and up to three *item categories* among a list of predefined categories that cover a large number of goods and services (Food and Supplies; Pets and Animals; Arts, Culture, and Entertainments; Collectibles and Decoratives; Helping hand and Manual Labor; Administrative tasks; Do-it-Yourself; Beauty and Well-being; Health; Energy and Heating; Childhood; Clothes and Shoes; IT and Multimedia Hardware; Informatics Software; Gardening and Nature; Living spaces and Housing; Tools and Equipments and Ustensils; Holidays, Week-end, Leisures; Books and Magazines; CDs, DVDs, Blu-rays, Discs; Sports; Transportation, Delivery, Pick-up, Moving; Vehicles and Means of transport; Other) [Reqt 3]. In addition to a *textual description*, *images* can be associated to an item so other users have access to precise information about it [Reqt 4]. Importantly, a physical *address* can be associated to an item [Reqt 2], hence each item can be displayed on an interactive map, so that other users can discover easily available items in their neighborhood (and be notified with approximate distance information [Reqt 7]). The address can be either very precise (including street name and number, or GPS coordinates) or rather vague (city name), the choice being left to the user to reveal or not their item precise location [Reqt 8,9]. In addition to user content, users can add permanent public resources (public bookcases, give boxes, free shops, solidarity fridges, drinking water sources, edible foraging spots).

Auto-completion mechanisms and content management

Encoding item metadata might take a while and can be a barrier to the creation of new content. We provide several mechanisms to ease this process [Reqt 5]. First, if an item is created directly from the map, its precise address is pre-filled in the item form. Alternatively, the item address can be directly copied from current user location (provided they accept geolocalization through their browser settings) or from their reference address encoded in their user profile. If an item is associated with a public resource (e.g. a request related to a community fridge), item categories are pre-filled and descriptions are suggested (e.g. "request to clean the fridge"). Moreover, once a user associates one or multiple images to their item, an auto-tagging workflow is executed. The first step uses a deep learning classification model that takes an item image as input and that outputs a term from a list of 1000 object classes. The five most likely terms can then be used to fill the title field of the item (e.g. tomatoes) and the chosen term is mapped automatically to one of the twenty Shareish categories (e.g. Food and Supplies) to auto-complete the category field. In addition, when the item image contains text, an OCR engine is used to recognize text and inserts the detected text into the description field of the item. This can be used e.g. to ease the encoding of books (as evaluated in (Guilliams, 2023)) or flyers announcing events. All these pre-filled fields can be manually edited. To further reduce manual encoding, a user can mark an item as recurrent to ease its resubmission at a later stage. For example, if a user has an apple tree and they have too much apples at each harvest, they can encode an item called "apples" and make it recurrent so that the next time they will go to this recurrent item and repost the "apples" without the need to encode details again (similarly for recurrent requests e.g. weekly grocery delivery; or recurrent events where only the start and end dates would need to be changed). The owner of an item can also set its visibility level: public (visible for all registered users), unlisted (only visible with the direct link to the item), or draft (only visible by the item owner). An item can also be deleted from the platform by its creator. To minimize efforts required to manage posted content [Reqt 4], a start date and an end date can also be specified, so that the item will automatically disappear after the end date. This can be used in multiple ways, e.g. to automatically delete past events or perishable items, or to request a service within a specific timeframe.

Interactive Map and List

By default, the interactive map and the listing-page show all items and are two complementary ways to access a Shareish server content. The interactive map allows users to explore data based on geographical locations using zooming, navigation, and address search. The item list enables sorting items according to various criteria (by publication date, start date, end date, distance, public comment counts, view counts) [Reqt 6], and displays item distance information as well as viewing counts [Reqt 7]. To further ease discovery [Reqt 6], filters can be applied both on the map and on the item list page, and these settings are saved. These filters can be a combination of item type, item category, item availability, item location, item publication date, item view status, or based on textual search (the search is performed over all item titles and textual descriptions). Such a combination of multiple criteria allows to search e.g. "unseen requests for help related to clothing in a neighborhood of 2km published during the last 2 days, sorted by distance". In addition to user contributed items stored in Shareish database, it is also possible to display and add on the map free

amenities (public resources) including public bookcases, give boxes, free shops, drinking water sources, food banks, soup kitchens, defibrillators (all interfacing with OpenStreetMap database), and falling fruit spots (interfacing with Falling Fruit, a crowdsourced database of fruit trees and edible plants on public land). Users can activate or deactivate their display on the map. By combining filters and check-boxes on the map, users can directly access relevant data in their current vicinity [Reqt 2,6].

Conversations and Public Comments

A Shareish server enables online communication between users through public comments or private interactive conversations. Public comments can be associated with items on each item details page. For each item, it is possible to start an online textual conversation between the provider and the receiver in the "Conversations" module. It allows to get further details about the item, to get to know each other [Reqt 8], and ultimately to arrange an appointment in the case of face-to-face interpersonal exchange (e.g. to reveal the exact address and choose the time at which the exchange could take place). The first message of a conversation is automatically suggested based on the item type and can be further edited before being sent. Both the UI and an e-mail mechanism are used to notify users when they receive messages to foster activity, similarly to notifications for items and events. Conversations can be searched (using item title). To prevent threats to user's personal privacy [Reqt 9], a user can lock (unlock) a conversation to stop receiving unwanted messages.

Technical Implementation

Delivering these functionalities in a way that is effective for users requires modern and robust architecture and user interfaces compatible with a variety of user devices [Reqt 1]. The architecture of the platform is depicted by Figure 2. It follows a representational state transfer (REST) Client-Server architecture style that structures database resources and that standardizes communication interfaces to improve interoperability. Our underlying data model, an extended version of (Guilliams, 2023), is implemented using a spatial, relational database where we store data related to the aforementioned concepts of users, items, and conversations (see Figure 3). Concretely, our implementation is divided into two main parts: the front-end (client-side, illustrated by Figure 4-10) and the back-end (server-side), described below. For each part we wrote source code following common practices in software development (incl. component-based and object-oriented programming practices) and we combined modern, popular programming languages and existing open-source libraries to facilitate its maintenance and reappropriation by other software developers.
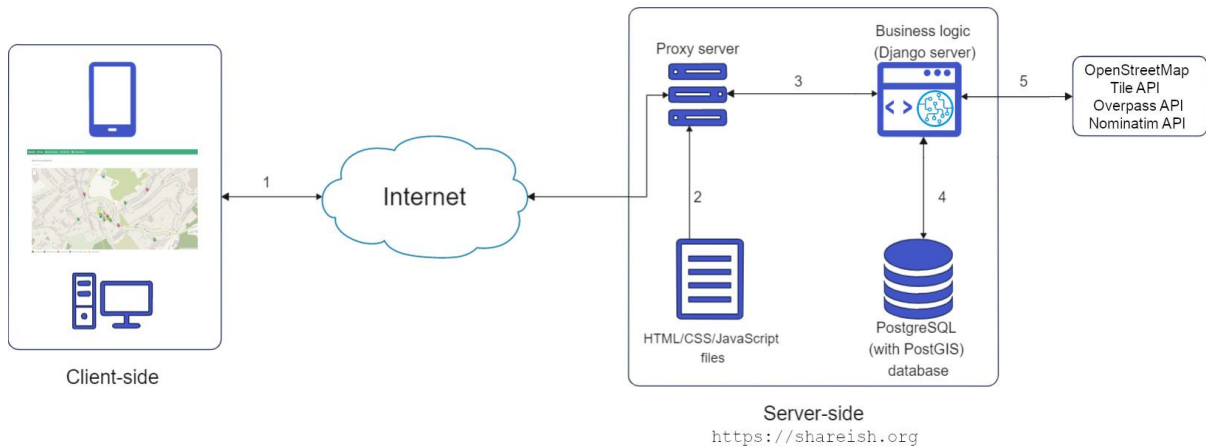
Figure 2. Overview of Shareish web architecture (Source: (Guilliams, 2023)). A Shareish server instance (here: https://shareish.org) can be accessed through various clients (web browser or mobile) which send requests to the server composed of three containers (proxy, web framework, database). The proxy server receives requests and redirects requests to the web container (Django framework) which handles the request and sends either SQL requests to the database container (PostGIS) to fill web pages with data user or item data, or requests to external APIs to load cartographic data, namely OpenStreetMap Tile API (to display map tiles), Nominatim API (to convert physical addresses to geographical coordinates), Overpass or Falling Fruit API (to display external data sources). The AI auto-tagging module is included in the web container.
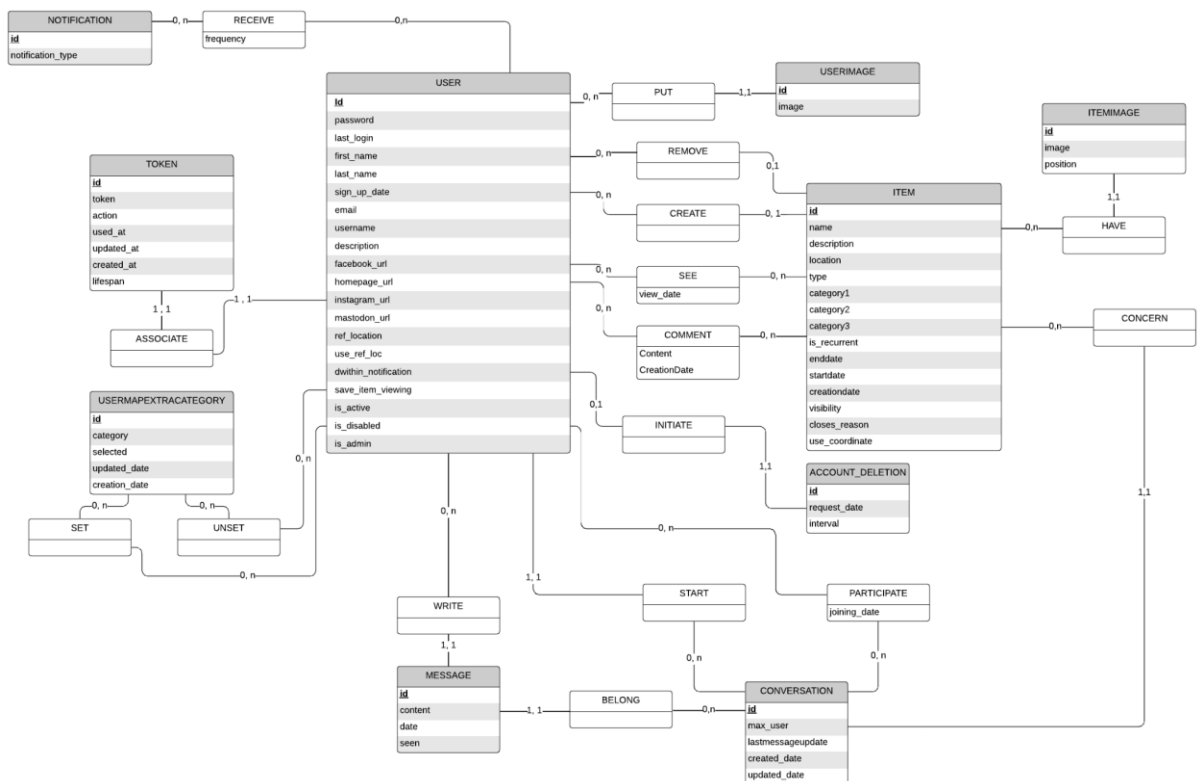
Figure 3. Overview of the Shareish conceptual data model with main entities: User, Item, Conversation (all details are not shown for readability).

Front-end

The front-end regroups all the code necessary for the web user interface and mainly revolves around VueJS (https://vuejs.org/), a modern Javascript framework for building modern, responsive, user interfaces. It is combined with Buefy (https://buefy.org/) that offers lightweight UI components based on Bulma (https://bulma.io/), and Leaflet, a JavaScript library for web mapping applications. We use Vue I18n internationalization plugin to support translation to different languages and localization (such as datetime), and tooltips to provide online, contextual help. The generic map data is fetched from OpenStreetMap API. Default map tiles are fetched from the humanitarian map style (http://map.hotosm.org/) which is focused on resources useful for humanitarian organizations and citizens in general, highlighting POIs like light sources, public and social buildings, …. Other tiling sources (e.g. transport map tiles) can be used at user convenience. On top of the map tiles, we display anchor markers, one marker corresponding to one user-created item. We use the Verbatim API to map an item address (as encoded by its user) to its geographical coordinates. Markers are colorized according to their corresponding *item type* (green for a donation, yellow for a loan, red for a request, and purple for an event). Current user location is displayed as a blue marker. A search bar allows the user to perform an address lookup (using Leaflet GeoSearch plugin) and moves the map to the corresponding location. In addition to user-contributed items, it is possible to display on the map other public free resources (such as public bookcases, community fridges, drinking water amenities, falling fruits, …) at their precise locations (as encoded in the OpenStreetMap or Falling Fruit databases) using markers with representative icons (from Wikimedia Commons). To add or edit these public resources, we integrated direct links with precise addresses to MapComplete (https://mapcomplete.org/), OpenStreetMap, and Falling Fruit editors (https://fallingfruit.org/).

As the number of map markers can be potentially large (e.g. there are almost 1.5M falling fruit and 250K drinking water locations worldwide), they are clustered thanks to the Leaflet Marker clustering plugin and displayed as one reach a certain zoom level in the map, which reduces the amount of data to transfer and to display. Going over a marker shows essential information (such as the item or public resource image, its type, a short description, and creator or source) while clicking on it will show full details and let the user starts a conversation with its creator, or associates a request to the public resource. In addition to the map, we also offer a "list view" of items with filters, following a listing-page design approach which loads content continuously as the user scrolls down (infinite scrolling). Similarly, users can get from there full item details and start conversations. In the Conversations tab, conversations are grouped by items. This module has been significantly modernized compared to (Guilliams, 2023). It now enables interactive chatting and allows text search to filter conversations.

Back-end

The back-end regroups everything that takes place on the server-side of the application. It relies on the Django framework written in the Python programming language. It describes how objects interact with each other (the "business logic" of the application) and it defines the methods to filter, add, update, and delete these objects. To save and retrieve data into and from the relational database, Django provides an ORM (object-relational mapper) library that provides means to interact with the database and convert objects within the Python

programming language into relational data in the database, and vice versa. User-created items are obtained through API endpoints that implements filters on item fields (e.g. to retrieve only "Food" items published in the last five days within a five kilometers radius), users (e.g. to retrieve only items created by a specific user), or title/description (e.g. to retrieve only items which have "cherry tomatoes" in their textual description). The API endpoint for items implements a pagination mechanism to enable progressive loading of large numbers of items, such as with infinite scrolling in the "browse items" front-end page. In addition to user contributed items, we call OverPass API to import OpenStreetMap data related to free amenities (and notify users when new public resources are created), and Falling Fruit API (https://fallingfruit.org/) to import free fruit locations. These external data sources are not explicitly stored in our database but retrieved (using current map location boundaries or neighborhood of the user's reference address) from the official OSM and Falling Fruit databases, so they are always up-to-date.

The messaging system (Conversations) is implemented using WebSockets (via Django channels) so that the Conversation module will refresh automatically to display new conversations and new messages, without the user having to explicitly reload the browser.

Database Model

We use a relational data model implemented using PostgreSQL (https://www.postgresql.org/). The data model determines the logical structure of our database where we store, organize, and manipulate data related to users, items, and conversations. We use PostGIS spatial extension (https://postgis.net/) to be able to perform operations on spatial coordinates, e.g. to compute the distance between current user position and an item. The distance is displayed in the item list, or used to filter items in the browse items listing page, or to notify users when a new item is created in their neighborhood. The Shareish conceptual data model is depicted by Figure 3.

Deep Learning for Item Auto-Tagging

Various approaches were evaluated in (Guilliams, 2023) to ease manual encoding of item metadata based on user-provided item images [Reqt 5]. These images are only transferred between the client-side and server-side of the application without using any external cloud services to preserve privacy [Reqt 9]. Deep learning models and computer vision workflows are automatically triggered by the back-end once a contributor associates image(s) to describe an item.

The first step uses a variant of a state-of-the-art deep learning model that is applied to predict the title of the item and infer its category. Compared to (Guilliams, 2023) where only a single image could be associated with an item, a user is now able to associate multiple images to an item. In this case, the model is applied to each image and term predictions are averaged. By default, the most probable term predicted by the model (among the 1000 nouns of the WordNet hierarchy used in ImageNet (Ridnik, Ben-Baruch, Noy, & Zelnik, 2021)) is then mapped to one of the 20 Shareish categories to automatically fill the first item category field. Users can choose another term from the list of the five most probable terms displayed in the item title dropdown, their choice being mapped into an item category accordingly. To further reduce manual encoding time, we applied in (Guilliams, 2023) optical character

recognition (OCR) techniques to detect textual elements in the uploaded item image hence auto-complete the item's description field. This was primarily designed for detecting the title of cultural items (e.g. books) or any other equipment whose name is visible (e.g. a household appliance). The analysis workflow is described and evaluated on books in (Guilliams, 2023). Here, it turned out to be interesting for other types of user content e.g. to analyze flyers announcing free events (e.g. a free market).

Because these auto-tagging approaches are prone to error and anyway users might want to add additional information about their items, predicted metadata are transferred from the back-end into the editable UI forms of the front-end. Hence, only user validated content is ultimately stored in the database.

Security

We implemented several security mechanisms such as HTTPS protocol, back-end URLs that can only be accessed by identified users (users will need to confirm their registration via email prior to being able to log in to the site), permissions (e.g. conversations are only accessible to the two involved users), and cross-origin resource sharing. User private information (such as names, e-mail, reference address) are not transferred to other users and only displayed in a user's own profile page for editing.

Deployment and Database Administration

As Shareish relies on various software technologies and because computing environments are heterogeneous (e.g. the server of a not-for-profit organization, the personal computer of an HCI developer, …), it is very important the design includes a reproducible, sustainable installation procedure to ease replication and updates of the platform [Reqt 10]. We use Docker Compose (https://www.docker.com/) container technology (Zhang et al., 2018) to encapsulate the software components. It eases the deployment of current and future versions of the Shareish platform, in two modes: local development mode, or production mode. Local development mode eases iterative development with hot reload mechanisms that allow software developers to change code locally and directly see their changes on the instance deployed on their personal computer. Communities will use the production deployment mode where Docker technology is combined with nginx proxy server (https://nginx.org/) to install the platform on a server and make it available straightforwardly to intended users through a web browser or mobile phone [Reqt 1,10].

If necessary, database content of a Shareish instance can be managed by logging into the database container, or more conveniently by using the Django admin module. This module reads Shareish data models and automatically provides a web user interface where trusted users (e.g. community moderators) can manage content [Reqt 9,10] using CRUD operations (create, read, update, and delete). A backup procedure has been implemented to safeguard the database content (including user and item images).

Actual Deployment of a Shareish Server Instance and Screenshots

We received approval from the GDPR office of the University of Liège to deploy a research demonstration server. A Shareish demonstration instance has been successfully deployed (https://shareish.org). The automatic installation procedure using container technologies takes about 10 minutes and includes automatic download of all libraries/modules, automatic build of front-end, back-end, database, and backup container images. Then, the automatic procedure to start all the platform containers takes about 1 minute. The same installation procedure has been tested several times on 7 different servers/laptops of our team members to assess portability and reproducibility. Thanks to the use of technologies described in the prevoius section, the technological burden is significantly reduced [Reqt 10] with respect to traditional deployment techniques where many manual configurations have to be set to run such a platform on a new host server. In terms of software maintenance, third-party organizations are able to install future versions of the platform by fetching the latest source code from our centralized repository. Then, the installation procedure consists in automatically rebuilding container images and applying database migrations (while keeping user data) as these operations are configured to occur automatically on startup. Our architecture (including back-end database and front-end mechanisms such as chunked loading and clustering) was designed to scale and it is robust enough to display a large number of items efficiently.

Since the end of 2022, in addition to our team members, 140 users have created an account (compared to 18 in (Guilliams, 2023)) following non-personal invitations on social media channels and advertisements directed to specific users from our professional and local networks. Thanks to the use of modern responsive design technologies, users have been able to successfully log in to and use the platform on various web browsers and mobile phones (Android, Windows, GNU/Linux, macOS, iOS). Some end-users created content (own items, events, or public resources, see Discussion) and provided various feedback that were translated into improved user interfaces. These changes have been continuously deployed on the demonstration server so that end-users were able to use different versions (iterations) of the platform. Readers are invited to test the latest version (Shareish v0.6 release at paper submission) and future releases deployed on our research demonstration server. The interactive Map page, the users interfaces to add items (with auto-tagging) and public resources, the "browse items" listing page, the page to view details of an item, the conversation module, and the page for setting notification parameters are illustrated by Figures 4 to 10. Notably, the appearance of user interfaces has been modernized since (Guilliams, 2023).
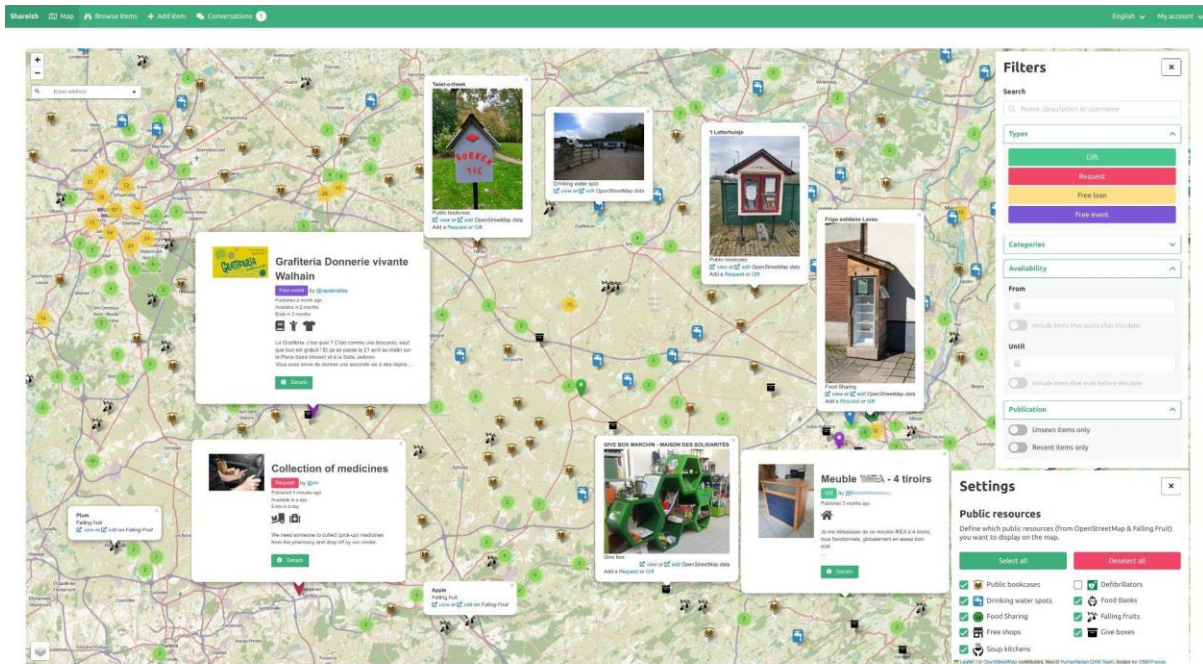
Figure 4. Shareish UI. Top: navigation bar with access to the map, the listing page, the add item page, conversation space (here: one unread message), internationalization, and account settings. Main view: the Map where users can navigate (zoom in/out, pan, locate), filter and select items, and enable/disable public resources. Here some content is selected on the map including a piece of furniture to give away, a free market ("*Gratiferia*"), a request for the pick-up and delivery of medicines, two public bookcases, a solidarity fridge, a give box, a drinking water source, two falling fruit spots (plum and apple). On the right, panels (which can be hidden) allow users to filter items and public resources.
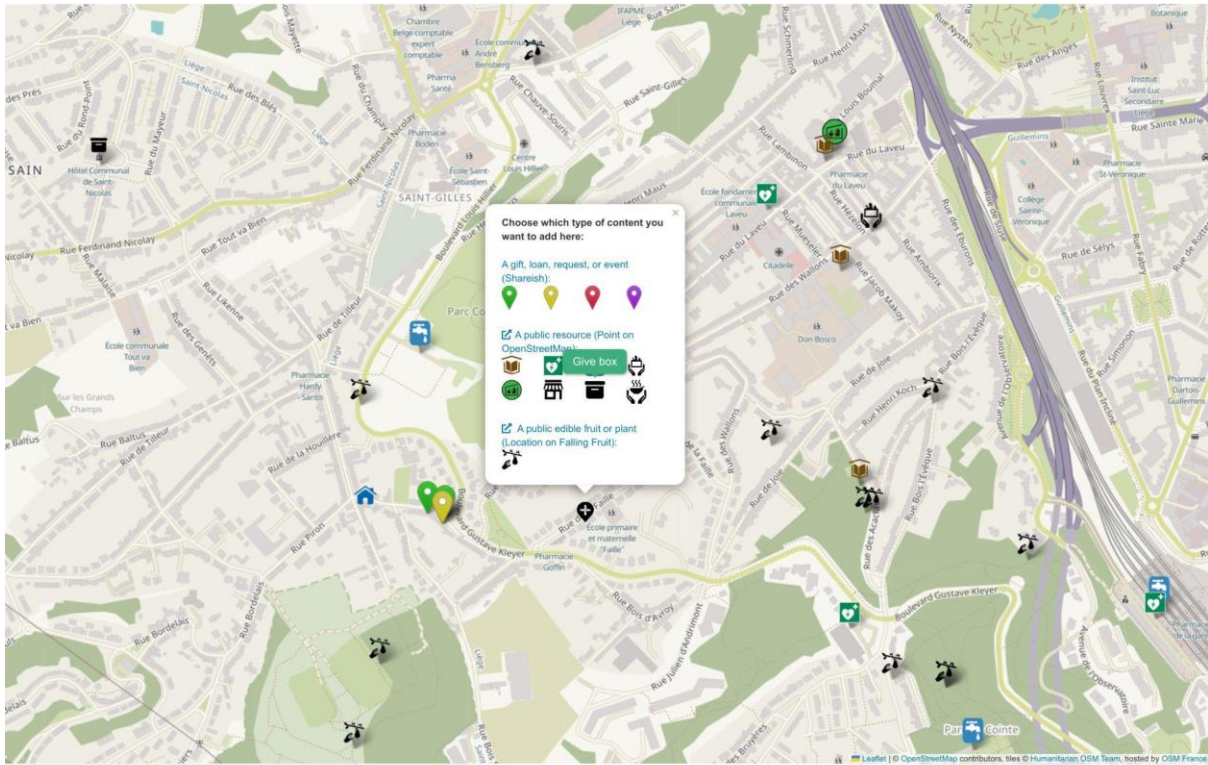
Figure 5. Shareish UI. A closer view of a neighborhood in Liège (Belgium) with a pop-up dialog triggered from a precise location on the map to add content (gift, loan, request, event, various public resources). Here, the user wants to add a give box with the precise GPS coordinates being automatically transferred to the public resource add module (MapComplete).
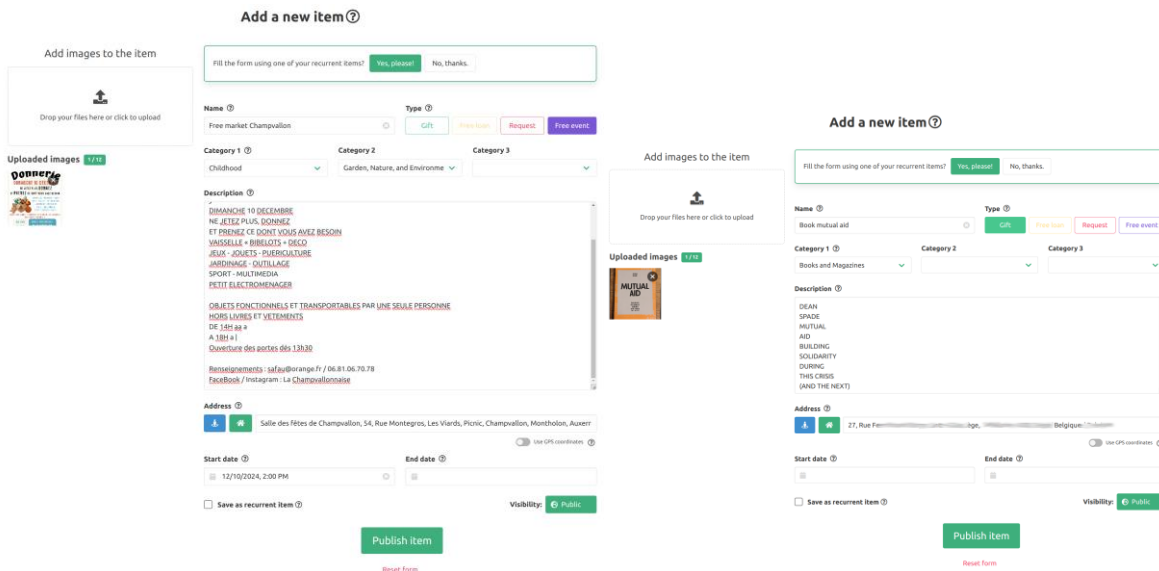

Figure 6. Shareish UI to add a new item. Left: A flyer announcing a free market is first uploaded by the user, with item Description being automatically pre-filled with text detected by the back-end auto-tagging module. Right: a picture of a book jacket with item Category ("Books and Magazines") and Description being automatically pre-filled. Users can edit all fields before (and after) publishing their item.
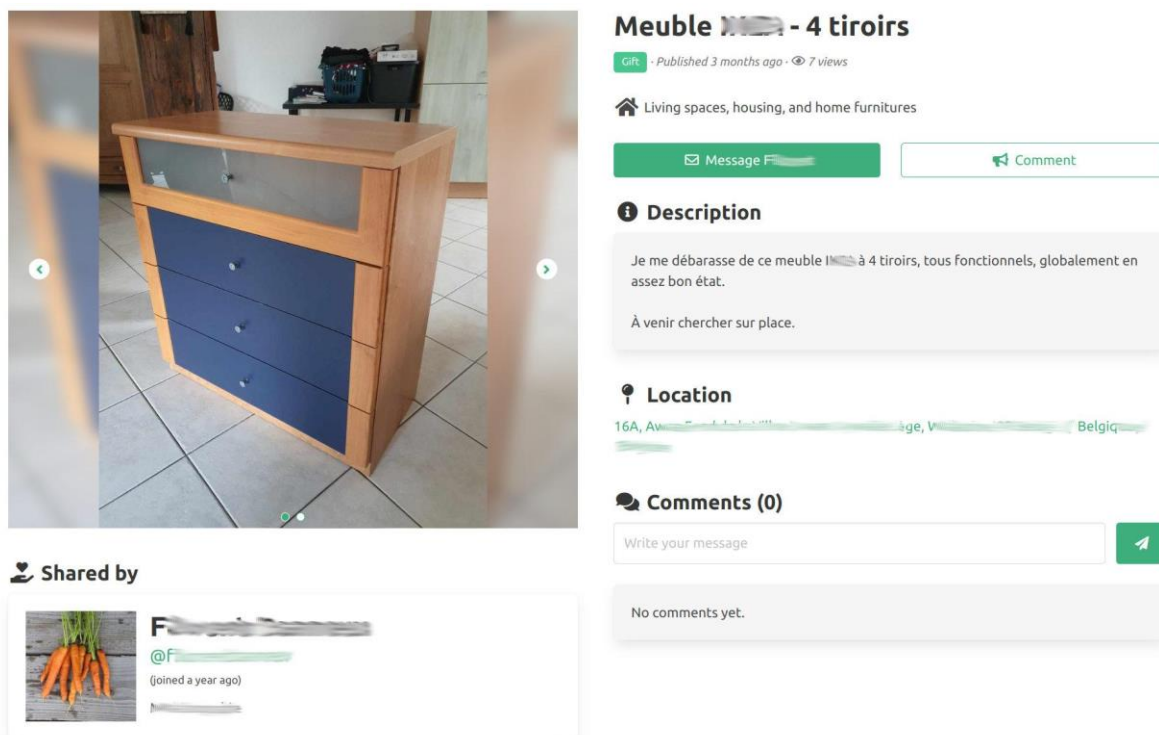
Figure 7. Shareish UI to view the details of a published item with Item image (left), type (Gift), title, description, and location (with direct link to the map); information about the giver (bottom left) and buttons to send a message (private conversation) or a public comment.
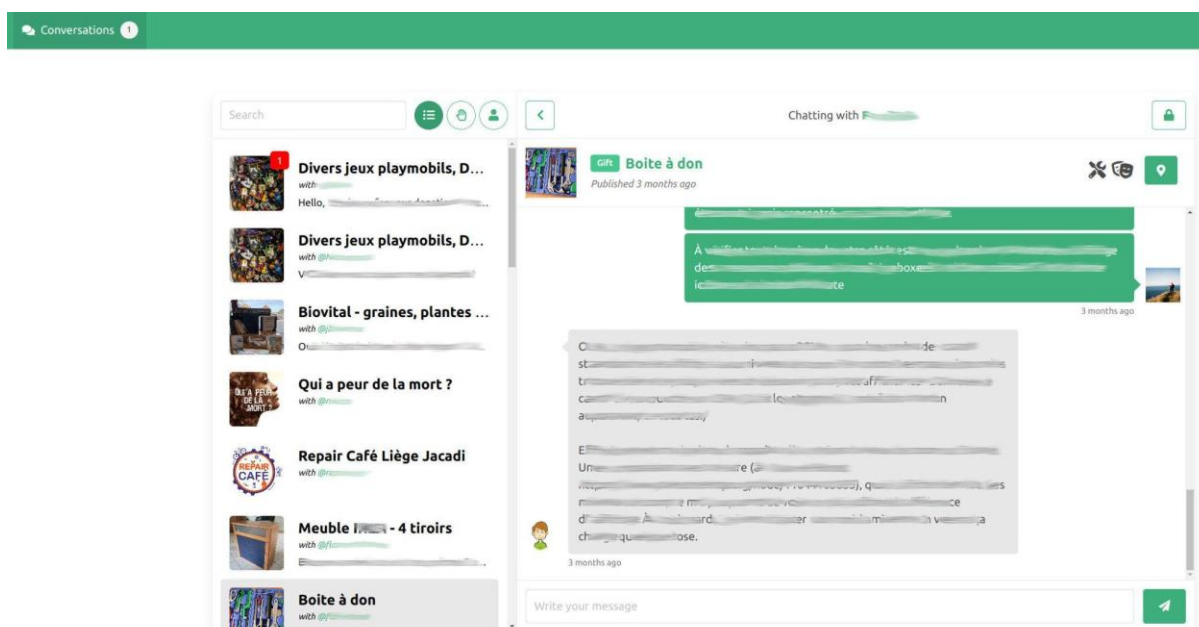

Figure 8. Shareish UI for online private conversations with list of open conversations on the left (including one unread notification), messages of the "boîte à don" conversation, button to lock the conversation (top right), and text field to send a new message (bottom). (Usernames and texts have been blurred for privacy)
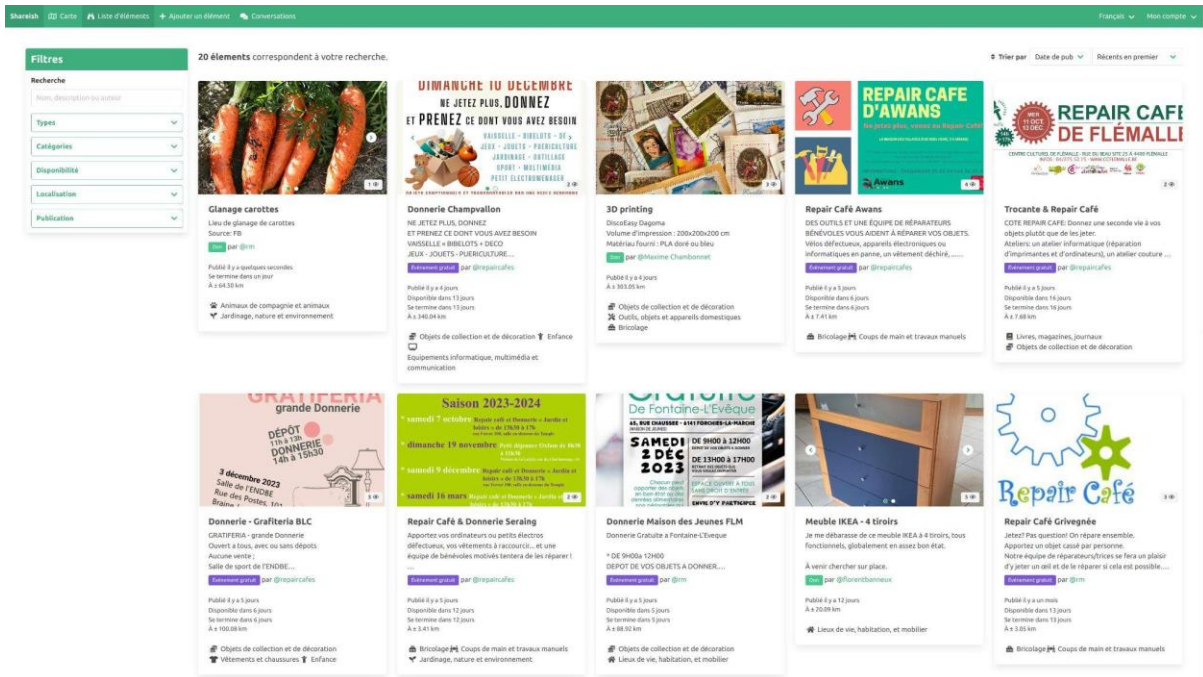
Figure 9. Shareish UI to browse items (listing-page). The list of items can be displayed according to the same search filters than on the Map page (here: none selected) and ordered (here based on publication date). Each item card shows the item image, creator, type, time frame, and categories; as well as distance from current position. The internationalization UI components allows to display the user interface in different languages and localization settings (illustrated here in French).
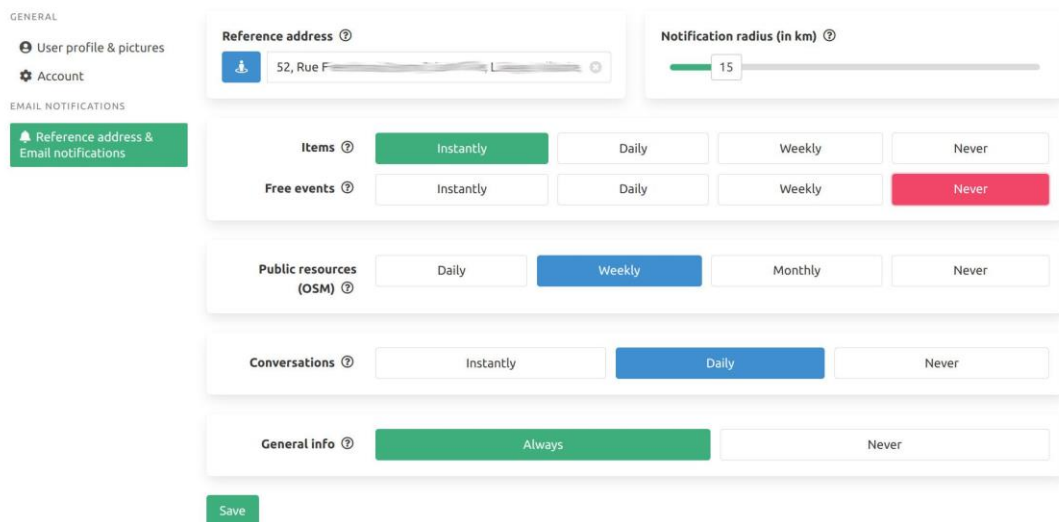
Figure 10. Shareish UI to configure notification parameters with the reference address and distance used to send notifications for new items, events, and public resources in their neighborhood; and the frequency of notifications (instantly, daily, weekly, monthly, never).

DISCUSSION OF LIMITS AND DESIGN OPPORTUNITIES

We have described our investigations of local solidarity practices and presented the extended design of Shareish's interactive system with the aim to facilitate a diversity of solidarity practices (including generalized exchange with face-to-face interpersonal exchange; gifting with no in-person contact through physical intermediaries such as in stooping or through the use of give boxes or public bookcases; free shops, or community fridges; gleaning or foraging, announcements of events such as free markets or repair cafés,...). We interviewed organizers of online and off-line solidarity communities, and conducted observations of online members. As we observed, actors have developed through the years some complex know-how to facilitate their operations. While Shareish echoes some of these processes, we will continue to endeavor to adapt itself to learn from these actors. A long-lasting influence should be sought by increasingly disseminating the tool, conducting additional in-depth case studies and by bringing together various stakeholders and involve them more directly in the development of future versions of Shareish. Our present qualitative study mostly focused on organizers, but more empirical research with members of sharing communities should be a priority in the future, as well as collecting feedback from actual and future users of the proposed platform. As we have observed on large online groups, there are very different participation frequency profiles. Our next qualitative investigations involve seeking participants of peer-to-peer exchanges for more in-depth interviews e.g. to understand the barriers to more frequent involvement in solidarity practices. While short-term techno-fixes are not a panacea (Morozov, 2013; Segal, 2017), it may happen that some barriers can be removed by adjustments. It was interesting to note how the welcoming appearance of the front window of a free shop could be used as a tool to convince outsiders to enter the shop (hence discovering the solidarity concepts behind it) as the free shop was regularly confused with any other commercial shop. In the same spirit, our user interfaces were designed to make non-monetary exchanges at least as user-friendly as commercial transactions on popular e-commerce and sharing platforms. Further improvements to enhance Shareish accessibility to a public less technologically inclined could certainly be developed. For example, some users suggested that creating a Shareish-specific account should be avoided to limit the multiplication of accounts, so single sign-on through existing social media accounts should be implemented to remove that barrier. We have identified other design issues, e.g. arising from the fact that we allow different types of content to be added as two different users wrongly used the add item user interface to add public resources (give boxes). Other technical and practical limitations might appear as the platform reaches more people from more diverse communities. This includes the fact that network connection might be unstable or limited in some world areas which would require improving the dependency on external servers (e.g. to get map tiles and public resources) and to implement local update and caching mechanisms to improve the resilience and responsiveness of a local Shareish instance. In terms of user experience, while Shareish is accessible on mobile phones as a progressive web application (it is delivered through web technologies to provide a user experience similar to a platform-specific application), developing a native mobile application could improve performance and usability. Modules to detect spams, bot flooding, inappropriate content, or aggressive messaging, might also be necessary to better protect users and communities against any threats. With the aim of identifying further platform limitations and continuing to

improve the tool, co-design and co-creation events are envisioned with various citizens and stakeholders of post-industrial cities within the context of a European project (UNIC "City Labs").

Following our interviews and online observations, we identified other design opportunities related to logistics, governance issues, and public communications. In terms of logistics, both free shop actors have mentioned that gifts could be possibly collected in a more efficient way and on a larger scale as surpluses (e.g. of unused clothes) are numerous. While Shareish user interfaces enable users to add requests (e.g. to pick-up items at a given location, or to request restocking a community fridge) and let users communicate through private conversations or public discussions, new software modules could be proposed for a more effective organization of such activities e.g. to collectively plan pick-ups and drop-off trips (including scheduling and routing), as observed in community fridges initiatives where simple online tabular sheets and posts on social media are sometimes used to organize the sharing of surplus food. Similarly, public resources are dynamic and we observed some communities have tried to combine various online tools to collectively check their status (e.g. to check the cleanliness of a community fridge). Such ideas and implementations from food sharing projects could be investigated and possibly adapted to other solidarity practices (e.g. free shops, give boxes, or public bookcases) (Berns, Rossitto, & Tholander, 2023). In terms of governance, we observed various conceptions, rules, and consequences related to topics such as free riding (e.g. reselling a good, obtained for free, outside of the community) or unreliable behaviors (e.g. missing an exchange appointment, or publishing false information related to unauthorized gleaning). Each community has its own set of rules (or absence of), decision processes, and ways to react. Interactive software modules to prevent unwanted behaviors could be investigated (e.g. a screen asking the user to confirm that they have the farmer's agreement before publishing a gleaning location). In parallel, software modules to establish, publicize, and implement community agreements could be envisioned to ease participatory democracy practices and collective organizing (Ruth, Prichard, & Swann, 2023) related to solidarity practices and public resources. In terms of public communication, some organizers might be interested in gathering usage statistics (e.g. the number of given clothes is marked with chalk on a free shop wall, or the size of a Facebook group is used to lobby for access to municipal buildings). Software modules could similarly gather platform usage statistics (conditional on user consent) and user feedback as a tool to assess and communicate their impact, justify their efforts, increase volunteer's motivation, or request support from public institutions. By regrouping and quantifying diverse, individual and collective solidarity practices, new Shareish software modules could offer more visibility to these initiatives, a better overview of their impact, and potentially inspire other initiatives. That being said, it will also be interesting in future work to take into account the digital divide (groups or individuals may have limited access to the Internet or different levels of digital literacy), to remember that the massive use of digital technologies is not neutral in terms of ecological impact, and that complex conditions or community issues are not necessarily best addressed with software technology (Baumer & Silberman, 2011; Morozov, 2013; Kidden, Strohmayer, & Yee, 2023; Sharma et al., 2023). If they succeed in fostering social ties between neighbors and if they contribute to multiplying the number of physical locations of exchanges and making them more visible, sharing platforms like Shareish may ultimately lead to a reduced reliance on energy-intensive technologies in the future.

Our qualitative study clearly underlines that such a software tool can not be implemented in a void but rather will be conditioned by the community in which it is applied, as there is no one-size-fits-all software program. In order to enable replication and local adaptation by groups seeking autonomy (Keyes et al., 2019), the platform is distributed under an open-source permissive license. Overall, we believe open source licensing and development is a necessary but most probably not sufficient condition for the sustainability of such a project "in the wild". Although free open-source licenses are irrevocable and therefore an open-source licensed software code will remain available for others whatever happens, the evolution of an open-source project is fragile (as individual coders come and go), and its governance is not straightforward (Lejeune, 2011b). Furthermore, local adaptations and a multiplication of self-hosted, distributed, server instances could make it more challenging to collectively organize a community of developers beyond the initiators of the project. To alleviate these concerns, different complementary approaches can be considered (Viorres et al., 2007; Coelho & Valente, 2017; Avelino, Constantinou, Valente, & Serebrenik, 2019; Poderi, 2019; Hamm, Shibuya, Ullrich, & Pargman, 2021; Ait, Izquierdo, & Cabot, 2022; Knutas et al. 2022; Qiu et al., 2023) including further sharing development tools and practices online to favor open participation, improving tool's interoperability, coordination and communication strategies to increase participation and maintain open source community dynamics by involving facilitators.

CONCLUSIONS

In this paper, we proposed an extended description of the motivations and of the technical implementation of Shareish (Guilliams, 2023), an open-source (https://github.com/shareish), online, map-based, interactive system to facilitate diverse non-monetary solidarity practices. The platform was designed for 'human' rather than market needs with the objective to facilitate the people's ability to meet their own needs through new community relations. Our design methodology combined an extensive literature review, online ethnographic observations, and a qualitative study with solidarity local actors. The platform is ready to use and can be replicated and extended freely. For future work, we identified avenues for furthering the qualitative study and design opportunities related to organization of solidarity community logistics, governance, and public communication. Overall, our work might be reappropriated by various communities including grassroots movements, emergency response organizations, social researchers, and HCI & CSCW developers.

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Authors' Note

All correspondence should be addressed to:
Raphaël Marée
University of Liège
Montefiore Institute B28
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