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The Sharing Economy and Digital Platforms: A Review and Research Agenda

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Abstract

Over the last few years the sharing economy has been changing the way that people share and conduct transactions in digital spaces. This research phenomenon has drawn scholars from a large number of disparate fields and disciplines into an emerging research area. Given the variety of perspectives represented, there is a great need to collect and connect what has been done, and to identify some common themes, which will serve as a basis for future discussions on the crucial roles played by digital platforms in the sharing economy. Drawing on a collection of 435 publications on the sharing economy and related terms, we identify some trends in the literature and underlying research interests. Specifically, we organize the literature around the concept of platform mediation, and draw a set of essential affordances of sharing economy technologies from the reviewed literature. We present the notion of platform centralization/decentralization as an effective organizing principle for the variety of perspectives on the sharing economy, and also evaluate scholars' treatment of technology itself. Finally, we identify important gaps in the existing literature on the relationship between digital platforms and sharing economy, and provide directions for future investigations.

INTRODUCTION

As many researchers of the sharing economy have pointed out, the act of sharing is not new; bartering systems and communal ways of life have a long history (Belk 2010; Sundararajan 2016; Albors, Ramos, and Hervas 2008). However, it is only in the last few years that an intense discussion of sharing and economic collaboration has risen up around the term ‘sharing economy’ (Cheng 2016). This is in part due to the fact that, although sharing has been around for a very long time, digital platforms and other large-scale mediating technologies have not. Indeed, much of the excitement over the sharing economy (hereon SE) and collaborative consumption surrounds digitally-supported businesses and communities which have enjoyed

commercial success in recent years, upsetting established institutions (Geron 2013; Zervas, Proserpio, and Byers 2014). As a result, the presence of such technologies has been put forward as a defining characteristic, separating those businesses and communities under the term “sharing economy” from traditional sharing contexts (e.g., Hamari, Sjöklint, and Ukkonen 2016; Bardhi and Eckhardt 2012).

At the heart of the rising concept of the SE is the role of digital technologies. In many conceptions, the SE system is predicated on some kind of efficient, scalable technology, which brings large networks of people together and matches them to the goods or services they need (May, Königsson, and Holmstrom 2017; Botsman and Rogers 2010; Allen 2017). The market successes of SE businesses, as well as the social futures of collaborative networks, are often tightly associated with the technologies on which they run (Frenken 2017). More broadly, the SE presents some novel contexts for the use of technology, and for the types of social relations which are carried out through digital channels (Schor and Fitzmaurice 2015).

A few recent studies have investigated the roles of mediating technologies (May, Königsson, and Holmstrom 2017; M. K. Lee et al. 2015) in the SE, but accounts of what exactly this technology is, and how it facilitates new social and economic configurations are scattered. In some discussions this technology is an ‘algorithm’ (Möhlmann and Zalmanson 2017; Lustig et al. 2016), while in others it is a ‘platform’ (Cheng, Fu, and de Vreede 2018; Scholz 2014), and in many more it is simply ‘technology’ (Heinrichs 2013; Cohen and Kietzmann 2014). Furthermore, there is not always agreement on these terms, as researchers have different definitions of an ‘algorithm’ and some publications describe the technology as a platform, but only concern themselves with one algorithmic process of that platform. In other cases, technological changes are reduced to quantifiable trends, such as increasing computational power, speed of match-making, or the ubiquity of personal devices, observations which circumscribe but do not explain technology’s role. This miscellany of perspectives is perhaps due to the dispersal of SE research across a number of fields, and it has spawned a number of explicit calls for a better conceptualization of SE technologies and mediation (e.g., Hamari, Sjöklint, and Ukkonen 2016; Martin 2016). Prior agendas have focused on the economic or social aspects of the SE (Cheng 2016; Oh and Moon 2016), but there has been no purposeful development of a shared understanding of the technological elements of the SE, and how it supports the SE’s observed sociotechnical phenomena.

As the notion of the SE is the culmination of a large number of economic, technological, societal, political, and environmental trends, perspectives on it vary widely (Acquier, Daudigeos, and Pinkse 2017; Dillahunt et al. 2017; Oh and Moon 2016). There have been a number of reviews which have previously sought to collect this literature into a coherent perspective, each taking a particular focus and disciplinary direction. Cheng (2016) reviews the SE literature from the perspective of SE business models and their implications for tourism services and sustainability development. Oh and Moon (2016) examine common definitions and articulations of the SE to describe its key components (i.e., open accessibility, trust, value creation, and peer to peer transactions). More recently, by reviewing articles published in the ACM (Association for Computing Machinery) digital library, Dillahunt et al. (2017) provide a useful perspective into the state of computing literature relative to the SE. With a specific focus on human-computer

interaction (HCI) they highlight major themes in this literature such user experience, design perspective, working conditions of gig workers, and business or pricing models. These reviews offer a thorough overview of common trends and perspectives in the SE literature, but their objective is not to examine the technological aspect of the SE or to engage the process of digital mediation directly. Some work still needs to be done to collect the variety of perspectives on digital mediation. Specifically, we must establish what is known (and what assumptions are made) about how platform technologies facilitate sharing and collaborative consumption.

The goal of this paper, then, is to surface the various assumptions about technology that are present in the research on the SE, and thereby deal with the presence of technology explicitly. We do this by describing a set of essential affordances assigned to SE technologies (explicitly or implicitly) in the literature. These affordances are presented as relations between the agencies of human actors and the material features of technology (Treem and Leonardi 2013; James J. Gibson 1978). These should be read as a summary of how the existing literature has characterized the critical roles of SE technologies. Unlike Chang's (2016), Oh and Moon's (2016), and Dillahunt et al.'s (2017) treatments of the SE, our goal is not to distinguish intellectual traditions in the SE or to enumerate essential aspects of SE research, but to synthesize different approaches to one aspect of the SE, namely technological mediation, from these different traditions and research disciplines. Furthermore, in contrast to a number of prior, influential papers in the SE literature (Ertz, Durif, and Arcand 2016; Belk 2014; Eckhardt and Bardhi 2015; Frenken and Schor 2017), our treatment is not definitional. In the methods section we describe how we operationalize the SE as a number of concepts and related terms, and we evaluate the treatment of technology under this operationalization.

Following Webster and Watson's (2002) recommendations about conducting a literature review on an emerging topic, we designed this review with the goal of exploring the sociotechnical nature of the SE, to explicitly engage with the mediating roles of digital platforms in these contexts, and to provide a theoretical foundation. In the discussion we set the stage for future work in this area by outlining some significant themes and weaknesses in the way that SE platform technologies have been described thus far, and ways in which technology has been blackboxed or taken for granted. We evaluate the current perspectives on technology in this area, and note some theoretical and analytical tools which could be applied to the SE context. Specifically we find that concepts from the literature on digital platforms would be useful in exploring the technological components of the SE. We also discuss two models of the SE platform, centralized platforms and decentralized platforms, which have served as central themes for organizing academic concerns, assumptions, and research interests. From these two analyses we identify some promising areas for future research.

METHOD OF REVIEW

Overall, the review approach adopted in this paper was concept-centric (Webster and Watson 2002), meaning that it followed the SE as a concept (specifically, a set of terms), rather than a particular research perspective or academic discipline. The review took two phases: an initial exploratory investigation, followed by a more extensive, guided collection. In the first phase of

the review, the researchers followed the terms “collaborative consumption,” and “sharing economy” in order to identify a first set of salient articles. Because the literature on the SE is new, fragmented and interdisciplinary (Cheng 2016; Puschmann and Alt 2016), we did not rely on a single set of journals or a single research area, but rather followed these two concepts into the various research areas where they have sparked interest, which range from marketing research to computer science to transportation. This first search was concerned primarily with papers which attempted to describe essential elements of the SE, either in its own right or in relation to an associated concept, and so most of the papers collected in this first search were those that provided a definition of the SE. Because the SE is an emerging research area, there are a number of associated terms in the literature, and not much strong consensus about the boundaries between them. The motivation for this first collection was to gain a handle on the variety of these concepts and to generate what Bates (1976) calls “entry terms” (see Table 1) for conducting a literature search and review. The result of this process was a set of core papers defining the SE and a set of relevant terms/concepts, which would serve as access points into the nebulous space of the SE literature and guide the second, larger data collection. Table 1 lists this first set of concepts, and the papers from which they were drawn.

"sharing economy", "shareconomy"	(e.g. Botsman and Rogers 2010; Sundararajan 2016; Ertz, Durif, and Arcand 2016; X. Cheng, Fu, and de Vreede 2018)
"collaborative consumption"	(e.g. Hamari, Sjöklint, and Ukkonen 2016; Ertz, Durif, and Arcand 2016; Möhlmann 2015b)
"collaborative economy"	(e.g. Kostakis and Bauwens 2014; Botsman and Rogers 2010; Martin 2016; Avital et al. 2014)
"gig economy"	(e.g. Martin 2016; Friedman 2014; Ferrell, Ferrell, and Huggins 2017; Acquier, Daudigeos, and Pinkse 2017)
"access-based consumption"	(e.g. Eckhardt and Bardhi 2015; Belk 2014; Dredge and Gyimóthy 2015)
“platform economy"	(e.g. M. A. Cusumano 2014; Kenney and Zysman 2016; Langley and Leyshon 2017)
"peer-to-peer economy"	(e.g. Sundararajan 2016; M. Cheng 2016; Kostakis and Bauwens 2014; Einav, Farronato, and Levin 2016)
"on-demand economy"	(e.g. Sundararajan 2016; van Doorn 2017; Einav, Farronato, and Levin 2016; J. Y. Chen 2017; Cockayne 2016)
“microtask”, “microwork”, “micro-tasking”, “micro-working” (with spaced and hyphenated variations)	(e.g. Dillahunt et al. 2017; Cefkin, Anya, and Moore 2014; Taeihagh 2017)

Table 1: Terms and concepts extracted from the exploratory search

Using the terms assembled through the first search, we conducted a second set of searches to collect a body of papers, which would be broad enough to express the main research agendas

present in the sharing economy literature. This search was conducted through Web of Science and was more formalized than the first, following a set of specific rules for excluding and including papers. In order to make use of standardized topic and discipline tags, we restricted our search to Web of Science. Use of Web of Science created a consistent and representative sample of the broader trends in the current landscape of the SE literature (Harzing and Alakangas 2016). We recognize a natural limitation of this focus, which excludes some possible literature. However, Web of Science provides access to a broad range of quality publications and research venues (Falagas et al. 2008).

All of the terms discovered in the first round of searching were incorporated into a search query, and the result set was restricted to books, book chapters, journal articles, and conference proceedings in the English language. Due to the ambiguity of some of the search terms, the result set contained some irrelevant papers. For instance, the term 'microworking' returned publications on nanotechnology which had no relation to the SE. To address this, papers which did not concern the SE in any way were removed from the review manually. Overall, the second search resulted in a final set of 435 publications.

By analyzing these papers, we sought to answer a set of questions about the ways prior research has conceptualized the SE as a process of technological mediation. Firstly, what technologies fall under the discussion of the SE? This means identifying what technologies a given paper discusses as examples of the SE, and, in the case of empirical studies, what businesses or applications they investigated. Secondly, how did the researchers conceptualize technology? This refers to the researcher's description of technology in terms of its importance, its agency, and its relationship with people and social structures. Thirdly, how do SE platforms mediate interpersonal interactions and economic exchanges? In other words, in describing a business or technology, what does the researcher consider to be the critical functions of the SE, which differentiate it from other business models or social arrangements?

In order to answer these questions, the researchers scanned the set of 435 publications twice. The researchers searched each paper for the sections where they imported, used, or contributed to the concept of the SE. They then identified which specific technologies each paper considered as examples of the SE, and evaluated the role assigned to digital technology within that discussion. In doings so, the researchers employed a thematic coding approach to identify recurring and significant themes within the SE literature (Buetow 2010; Saldana 2015).

Themes were constructed and refined around key affordances of digital technologies in enabling the SE mechanisms. An affordance approach is useful because it illustrates consistent ways technological components and features enable social transactions and processes (Treem and Leonardi 2013). Through this approach, we are able to describe the various roles researchers assign to technology in specific business models or applications. For instance, if a paper approached the SE through the issue of bias in match-making on Taskrabbit, it was considered as positing match-making as a critical affordance of Taskrabbit as an SE technology. Articulating these affordances helps explain the dynamic roles of digital technologies by integrating both the material nature (or design) of these technologies and their specific context of use and application (Evans et al. 2017). Attention was paid to those technological

affordances, which, in that author's reasoning, enabled the SE as a social and economic model. From these descriptions, the researchers aggregated a set of patterns of mediation, or ways in which technology enables different aspects of exchanges in the SE.

The second round of coding followed the logic of the first round, consolidating and solidifying the codes which had been established. In the process of coding, the authors consulted on papers which contained descriptions that were exemplary of a given affordance, as well as papers that were difficult to characterize. Continuous conversations between the two authors helped refine the list of affordances, and facilitated iteration between specific papers and perspectives in the collection and emerging categories of affordances, as instructed by Wolfswinkel et al's (2013) process of emergent analysis.

Figure 1 provides an outline of the review approach employed in this article based on a taxonomy of literature reviews formulated by Cooper (1988). The goal of this review is to identify conceptualizations of technological mediation in the context of the SE through a neutral representation of different perspectives and research traditions. By drawing on Web of Science, the review is meant to be a representative sample of existing literature on the SE.

Characteristics	**Categories**			
Focus	Research outcomes	Research methods	Theories	Applications
Goals	Integration	Criticism	Central issues	
Organization	Historical	Conceptual	Methodological	
Perspective	Neutral representation	Espousal of position		
Audience	Specialized scholars	General scholars	Practitioners / politicians	General public
Coverage	Exhaustive	Exhaustive and selective	Representative	Central/pivotal

Figure 1: Characteristics of the review approach. The aspects employed in this review are indicated by the shaded regions.

FINDINGS

An overview of the papers collected shows that research on the SE is nascent, emerging in the last few years, and dispersed, spanning a number of research areas. Figure 2 shows the rapid increase of publications on the topic since 2008, with the majority of the literature published after 2013. Table 2 shows the top 10 research areas represented in the reviewed papers, as defined by Web of Science's research categories. None of the categories was tagged in a

majority of the papers, suggesting that the literature on the SE is dispersed. The categories represented, however, reflect the SE's interest as an economic, business-related, or technological phenomenon. Similar to the trends observed in Dillahunt et al., (2017), and Cheng (2016), there was a significant amount of research on the SE as a business and economic model.

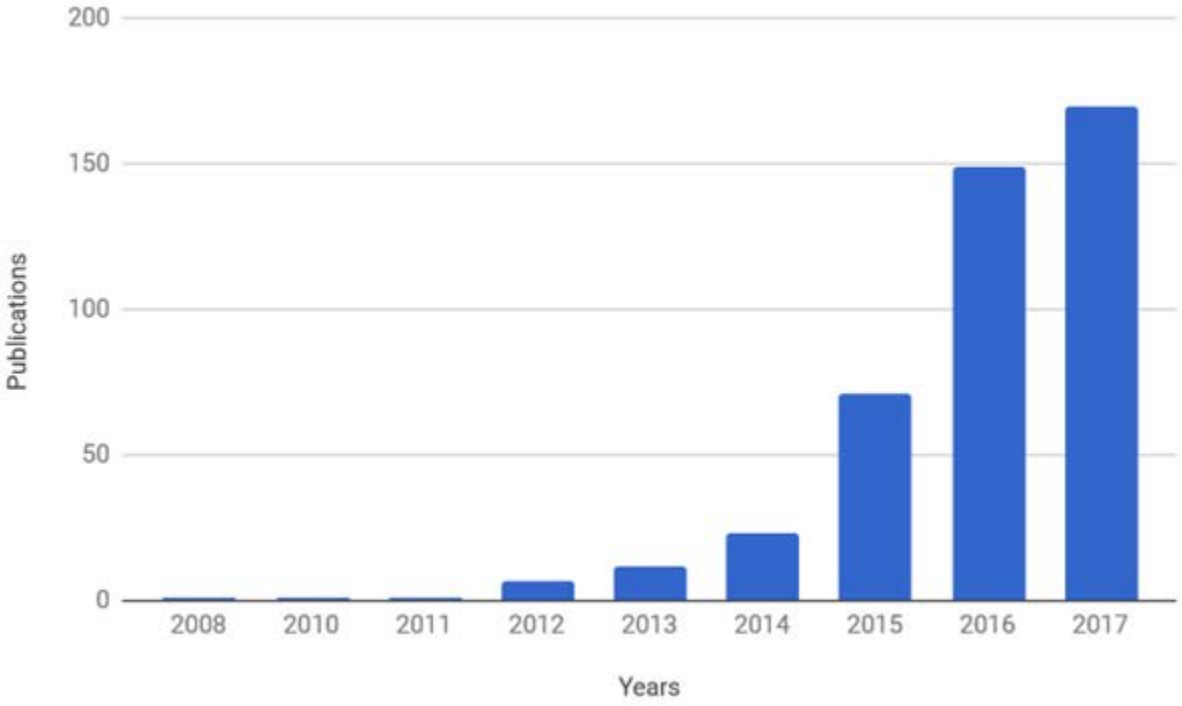

Figure 2: Search results by year.

Web of Science Category	Example Venues	Publications	% of Reviewed Publications
Business & Economics	Management Science, Journal of Business Research, Review of Keynesian Economics	154	35.40%
Computer Science	International Conference on Computer-Human Interaction, Hawaii International Conference of System Sciences, Communications of the ACM	118	27.13%
Engineering	Business and Information Systems Engineering, Applied Energy	72	16.55%

Environmental Sciences & Ecology	Journal of Cleaner Production, Resources Conservation and Recycling, Ecological Economics	44	10.11%
Social Sciences	Human Relations, Tourism Management, Journal of Travel Research	36	8.28%
Government & Law	Policy and Internet, European Journal of Risk Regulation, Internet Policy Review	31	7.13%
Science & Technology	Issues in Science and Technology, Journal of Cleaner Production, Sustainability	24	5.52%
Geography	Landscape and Urban Planning, Geoforum, Journal of Transport Geography	22	5.06%
Public Administration	Technological Forecasting and Social Change	21	4.83%
Transportation	Transportation Research, ITE Journal, International Journal of Sustainable Transportation	17	3.91%

Table 2: Papers by Web of Science Research Category

The empirical base of the literature encompassed a large variety of digital applications, ranging from the web-based businesses to community action movements. The literature spanned commercial and subscription services (e.g., Lyft, Rent the Runway and Couchsurfing), and not-for-profit services (e.g., timebanks and Sharetribe). The products and services exchanged on these applications and technologies also varied significantly, including goods (e.g., Babyloania), services (e.g., Fiverr and Sweepsouth), workspace or land (e.g., Deskcamping and LandShare), and loans or funding capital (e.g., Prosper and Indiegogo). A small part of the literature applied the concepts of sharing or collaborative consumption to more generalized websites like Twitter, Facebook, Google, or Wikipedia. In addition to these empirical contexts, a large number of studies used systems designed by the researchers (and utilized in research labs or experimental settings), or mathematical models as an empirical object (e.g. Weber 2014; Akasaki et al. 2016; Kung and Zhong 2017).

The findings reinforced the notion that digital technology is a critical element of the sharing economy, with 91% of the papers reviewed addressing the role of digital technology as an element of the SE. However, there was a strong focus on a few prominent commercial platforms (Fig. 3). Most prominent in this group were Uber and Airbnb. These two sharing businesses are in fact common examples of the SE business model, against which other businesses are compared. Mikhalkina and Cabantous (2015) describe how Airbnb, after its initial success, provided a template for understanding new sharing economy services as they arose. Certain trends in the gig economy, for instance, were encapsulated in the term 'Uberization,' referring to

the individualization of work risk and responsibility (Fleming 2017; Aloni 2016). In other words, the name of the company has become a keyword for an archetypal business model, which centers around a digital, algorithm-driven platform space, and promotes autonomy and flexibility amongst producers and consumers. The empirical focus on Uber and Airbnb suggests that these two platforms have become the primary vehicles for discussions of the SE in academic research as well. Analysis of newer or less prominent sharing economy systems may be occurring under the same dominant template drawn from the Uber and Airbnb example.

Technological platform	Publications referencing	% of publications
Airbnb	92	21.15%
Uber	86	19.77%
Amazon mechanical turk	51	11.72%
Taskrabbit	23	5.29%
Zipcar	18	4.14%
Crowdflower	18	4.14%
Lyft	15	3.45%
Couchsurfing	14	3.22%
Car2go	9	2.07%
Relayrides	8	1.84%

Table 3: Platforms most referenced as examples of the sharing economy

The Roles and Affordances of Sharing Economy Platforms

In order to summarize current understandings of digital mediation in the SE, we focus on the roles commonly assigned to digital platforms in the literature. Because of the variety of applications and SE contexts, we have abstracted these characteristics as technological affordances, which support sharing and collaborative exchange. We adopt the definition of affordances presented in Gibson (1979) and adapted in Treem and Leonardi (2013). This definition describes affordances as relational between actors and materialities, considering both the rigidity of technological/material things and the purpose of human actors (Pee 2018). The affordances presented here should be interpreted as relationships or productive strategies, which participants in the SE can establish with the materialities of SE platforms. Whereas these affordances are inseparable from the specific applications on which they might be enacted, they are not solely technological materialities, but utilities constructed by actors leveraging digital platforms or technologies, sometimes multiple applications in concert (Nelson, Jarrahi, and Thomson 2017). In contrast with prior characterizations of the sharing economy, such as

Botsman and Rogers' (2010) or Eckhardt and Bardhi's (2015), these affordances are not economic behaviors or market strategies, but rather productive relationships between people or groups and technology. In other words, we attempt to define 'technology' in the sharing economy by describing its emergence from interactions with humans strategies and goals. Inductive data analysis identified six affordances, which are described in the following section: generating flexibility, match-making, extending reach, managing transactions, trust building, and facilitating collectivity.

Affordance	Description
Generating Flexibility	The provision of rapid, dynamic access. Resources, work, or labor can be accessed on-demand, and participants can contribute in different roles.
Match-Making	Participants are brought together based on their needs or what they can provide. The platform optimizes this process through algorithmic or digitally-supported filtering, evaluation, and searching.
Extending Reach	The depth of access provided by the platform, in terms of scale, distance, and heterogeneity of resources and peers. Participants can reach more resources, more different kinds of resources, more distant resources, and resources which were previously inaccessible or idle.
Managing Transactions	The mediator handles the logistics of the transactions, either by holding currency, providing security, recordkeeping, or providing a workspace for the completion of a task.
Trust Building	The mediator establishes a system of legitimacy, encouraging participants' confidence in other participants, and in the process of mediation itself.
Facilitating Collectivity	The mediator encourages, and benefits from collective action. Participation in the SE is entangled with larger social movements, and the mediator builds off of the social capital of communities, neighborhoods, or professional groups.

Table 4: Affordances of the SE mediator

Generating Flexibility

A significant topic in the publications reviewed was the SE platform's ability to create flexibility for the user. Primarily this was flexibility in when and how the participant can participate (e.g. Ke

2017). Many platforms allow open sign-ups, encouraging people to join and contribute by making it easy to do so. Platform features like rating systems can raise some internal barriers to new users by making it harder to establish a reputation within the network (Einav, Farronato, and Levin 2016), but joining a SE platform is often less involved than similar processes in the traditional labor market, making it a more accessible option for part-time work (Arita, Hiyama, and Hirose 2016; Dillahunt and Malone 2015). This is perhaps more evident in the case of Uber, as becoming an Uber driver involves fewer obstacles, and provides greater freedom of working hours to drivers (Glöss, McGregor, and Brown 2016).

Researchers have also become interested in how the flexibility of roles supported by a digital platform influences the way people participate, and their contribution to the network. The ability to use an SE platform irregularly, and at need, is an essential aspect of its success as a business model, as it encourages both consumption and contribution from participants (M. K. Chen and Sheldon 2016; Philip, Ozanne, and W. Ballantine 2015). The ability to switch roles, combined with the ease of using most SE systems means that users can easily and efficiently contribute their idle resources (time, goods, skills), such that even a casual hobbyist can contribute as a producer (Bauer and Gegenhuber 2015). In this way, the network cultivates a population of "working consumers and consuming producers" (p. 663), an arrangement implied by the concept of 'peer-to-peer economy'. Implicit in this peer-like arrangement is a certain amount of autonomy on the part of the individual to carry out their own exchanges, as well as an openness throughout the network towards user contributions (Ertz, Durif, and Arcand 2016; Schor et al. 2016).

More technology-focused research in HCI has looked at the role of the platform or application in creating flexibility. For the mediator, maintaining flexibility requires balancing consumption and contribution from participants. Maintaining balance requires eliciting contributions from a population of participants when demand is high, and some attention has been focused to the ways in which platforms exert control over the consumption and production activities of their users (Querbes 2017). Carroll and Bellotti (2015b) speculated that a context-aware system could prompt participants to make contributions at particular times. Other studies have investigated how similar features motivate or cajole people into working at certain times through automated emails, sign-up windows, or algorithmically controlled pricing systems (Alkhatib, Cranshaw, and Monroy-Hernandez 2015; M. K. Chen and Sheldon 2016; Ravenelle 2017). This tactic of exerting control while maintaining the appearance of flexibility is put forward as a kind of 'soft control' (Rosenblat and Stark 2016). The workers' flexibility, and by extension their agency, is therefore based on negotiations and information asymmetries carried out through various digital materialities, a fact which has brought a great deal of interest from researchers of governance, sociology, and labor relations, especially in the broader context of entrepreneurialism and precarious work in the gig economy (Friedman 2014; Dunn 2017; Schor and Attwood-Charles 2017; Minter 2017).

Match-making

The viability of large-scale sharing or collaborative networks is based on the presence of a coordinating digital platform, which matches users across a large network based on a set of

attributes (Puschmann and Alt 2016; Benoit et al. 2017). SE platforms are entangled with web 2.0 cultures of digital production and participation (Banning 2016), and, as pointed out by Bauer and Gegenhuber (2015), the digital framework of the SE means that the participant is no longer limited by distance, only by the problem of sorting through large groups of people. Sorting and matching has therefore emerged as one of the primary benefits of the SE platform, as automated matching lowers transaction costs, and removes the need for institutional bureaucratic overhead (Carroll and Bellotti 2015b). Furthermore, it allows applications like Uber to connect people effectively in real time. This occurs through two converging methods: algorithmic assignment, in which an algorithm assigns participants to each other based on a set of attributes (i.e. the participants' locations), and active searching and sorting, in which the participants make use of a variety of digital features to evaluate their peers, and negotiate exchanges. A significant design decision in SE platforms is the extent to which they automate the match-making process.

Greater automation is faster and requires less responsibility on the part of the user. Research in the area of computer science approaches match-making as an optimization problem, determining matches based on a set of objective criteria, such as the participants' locations (Masoud and Jayakrishnan 2017). Sociotechnical approaches consider the interpersonal and societal effects of matching based on personal traits. A context-aware matching algorithm, for instance, could bring members of a community together in a variety of professional and social functions, based on a holistic evaluation of their interests or needs (Carroll and Bellotti 2015b). Such an algorithm can also cut the user out of the matching process, resulting in matches with which users disagree and attempt to circumvent. Uber and Lyft drivers, for instance, have little choice in whom they are matched with, and sometimes find themselves assigned to drive long distances to pick up riders for very short-distance fares, resulting in little or no profit for the driver (Raval and Dourish 2016; M. K. Lee et al. 2015). There is some friction, therefore, between the automation of matching processes and the autonomy of users, which has led to some disagreement about the role of algorithms in establishing interpersonal relations (Möhlmann and Zalmanson 2017).

Platforms also provide a space for participants to carry out their own evaluating and matching based on provided reputation systems, and this has sparked research on the social and interpersonal dynamics of matching. This research has focused on interactions through the platform's embedded profile representations and its measurements of reputation (Harvey, Smith, and Golightly 2017). For instance, the presence of photos on Airbnb profiles has a significant effect on people's choices of whom to contact, and the participant's expression in the photo has a further impact (Ert, Fleischer, and Magen 2016; Fagerstrøm et al. 2017). Other research has focused on racial or socioeconomic factors in the way people match up in the platform space. Thebault-Spieker, Terveen, and Hecht (2017), for instance, follow the effects of travel distance and socioeconomic status on task selection on Taskrabbit and Uber, finding that the socioeconomic status of the area affected participants' decisions significantly. Research has also identified racial and socioeconomic discrimination in matching mechanisms on platforms such as Uber and Airbnb (Edelman, Luca, and Svirsky 2017; Schor and Attwood-Charles 2017). Match-making has consequently become a topic of interest for researchers investigating the regulation and governance of platforms and platform labor (Leong and Belzer 2016).

Extending Reach

A primary theme in the business and economics literature is the scale and reach of SE platforms. In a broad sense, the essential benefit that SE systems offer is not a product or service in the traditional sense, but rather access to a large network of providers, consumers, or resources (Cohen and Kietzmann 2014). Extending reach refers to the depth of access provided by a SE platform, in terms of scale and global extent, as well as its access to underutilized assets (Cusumano 2014).

Scale is perhaps the most prominent aspect of reach, as it affords the benefits of network externalities. By relying on a population of contributors, a platform can stock itself with valuable content and resources beyond what a traditional firm could reasonably produce (Cusumano 2010). Managing user-produced content at this scale, however, requires relying on the processing power provided by digital applications, and the role of technology is often reduced to this processing function (e.g. Cohen and Kietzmann 2014). The automation provided by digital platforms, however, also enables particular structural characteristics of SE systems, which allow them to benefit from scaling (Irani 2015). This is significant because it means that the network can grow exponentially, and that the quality of the product improves as the network grows, allowing that growth to feedback on itself (Cusumano 2014). A new platform must reach critical mass by attracting enough users that it can provide a useful density of connections (Botsman and Rogers 2010). Very large networks benefit tremendously from network externalities, meaning that they are attractive to new users simply because of their size (Dreyer et al. 2017). It is therefore difficult for new SE systems to establish themselves, especially given the presence of larger collaborative networks (Lampinen, Huotari, and Cheshire 2015; King 2015). Structurally the peer-like nature of the SE network is designed to benefit from (and relies on) a large population of active participants.

Reach refers not only to scale in terms of the number of people a platform coordinates, but also in terms of its reach across distances, and into untapped reservoirs of idle resources. This global reach allows an SE network to establish connections with consumers or producers internationally, or between neighborhoods, an important factor for those in isolated or disadvantaged communities (Dillahunt and Malone 2015). Additionally, automated matching can put the individual in contact with resources that may be local, but were somehow secluded, idle or previously invisible (Botsman and Rogers 2010; Eckhardt and Bardhi 2015). Unused goods, as well as the talents of hobbyists or part time workers, are surfaced and brought back within reach of the network (Bauer and Gegenhuber 2015).

Managing Transactions

HCI and organizational research has taken an interest in how SE technologies provide material resources for conducting transactions. As a digital mediator, an essential function of the SE platform is to handle the logistical problems of transferring and securing goods, information, or labor (Täuscher and Laudien 2017). In the context of labor, a platform might function as a digital workspace. Mechanical Turk, for instance, provides tasks, which are meant to be completed within a webpage (Deng, Joshi, and Galliers 2016). Similarly, Upwork provides digital “work diaries” which keep track of the hours and tasks a freelancer accomplishes as a way of

evaluating and promoting productivity in the tasks completed on the platform (Spreitzer, Cameron, and Garrett 2017). Platforms also provide various applications to help users connect and assure the security of connections, such as routing applications used in ridesharing (Teubner and Flath 2015). These features make the platform a kind of digital workspace, which contains the infrastructural resources that participants need to make exchanges or complete tasks.

Given its facility as a digital workspace, the design of interfaces and task environments is a critical area of research on transaction management. The notion of the platform as a workspace is of particular interest in the micro-tasking context, where tasks might be accomplished within a webpage. The interfaces and algorithms which operate such a workspace are a direct means of managing and mobilizing 'humans-as-a-service,' defining their relationships with those posting jobs, and making their labor accessible in an on-demand fashion (L. Irani 2015; Lehdonvirta 2016). The order in which tasks are presented and the forgiveness for failure built into the process changes the way participants work, and can change a worker's efficiency (Krishna et al. 2016; Rahmanian and Davis 2014; Tranquillini et al. 2015). Interface and task design are also important for those with disabilities, a group for whom the sharing economy potentially represents an important source of work. The accessibility of interfaces, time limits, and methods of evaluation can be unexpected obstacles for this group (Zyskowski et al. 2015).

As a mediator, the platform also plays the role of bookkeeper. This involves not only keeping a record of exchanges but also enforcing the validity of those exchanges through escrow or insurance (Carroll and Bellotti 2015a; Weber 2014). In this role the platform provides assurance of a transaction, both by adding security measures to the transaction itself (Son et al., 2014), and by actively punishing users who fail to carry through on their transactions and reimbursing users who have been cheated (Sundararajan 2016; Deng, Joshi, and Galliers 2016). Lampinen and Cheshire (2016) for instance, found that the automated nature of the transaction not only increases the convenience of connecting with others, but also improves the amount of trust held on both sides of the transaction. Because the money is handled automatically and somewhat covertly, both participants are saved some logistical hassle or social awkwardness in carrying out the transaction themselves.

Trust Building

Carrying out transactions on a digital platform allows people to improve or extend interactions across weak, anonymous connections, where distrust is a large obstacle (Kim, Yoon, and Zo 2015). Sharing often involves users meeting in person, sharing vehicles, or lending each other valuable belongings. These are somewhat personal interactions, which are chaperoned and assured by a number of digital features, the most common of which is the rating system, along with other kinds of evaluative features like user reviews (Ikkala and Lampinen 2015). Profiles have become popular as an extension of the resume, a place to provide qualifications, biographical information, and generally deanonymize oneself (Sarasua and Thimm 2013; Ma et al. 2017). Research has shown that the simple addition of a trustworthy looking photo to one's profile can substantially improve the trust felt by other users (Ert, Fleischer, and Magen 2016; Germann Molz 2013; Fagerstrøm et al. 2017). In all cases, these features face the difficulty of

integrating themselves into existing social norms and functions, a process they perform with some awkwardness. For example, users have different understandings of the meaning of ratings, or are frustrated by the narrow throughput of these features, as they do not allow for qualitative feedback (Raval and Dourish 2016; Glöss, McGregor, and Brown 2016).

Another perspective on trust considers trust between the user and the platform itself (Huurne et al. 2017). A user's trust in the matches made by a mediary is contingent on their trust in the mediary's capability or wisdom in making trustworthy connections. In a study of Car2Go and Airbnb, (Möhlmann 2015a) identifies trust and a lack of consistent experience as a potential weakness of the SE model versus traditional business models, making trust-building aspects of the SE platform critical to the business model's success. Matching and searching algorithms in particular are focal points for this evaluation of SE systems, as they are often opaque, and tend to make judgements of users with impartiality (Deng, Joshi, and Galliers 2016). There is also a generalized concern that platforms can control which connections are made, and which users are able to make connections, by altering the algorithm.

Beyond the strictly technical processes of the platform, trust is also evaluated on the ways in which a platform manages its community of users. This manifests as a number of policies, carried out by human or algorithmic representatives of the platform, which encourage participants to perform effectively, and remove users whose ratings drop below an acceptable level or who post malicious offers (K. Lee, Webb, and Ge 2015; Rosenblat and Stark 2016). Whereas the typical platform attempts to keep a low barrier for new users joining the platform, many do perform background checks for providers to screen out dangerous or unreliable participants (Glöss, McGregor, and Brown 2016). On many platforms, these checks also include competency tests in order to assure quality of service (De Stefano 2015). Platforms might also conduct direct surveillance of participants or encourage them to leave ratings for other users. These activities cultivate a robust system of reputation and accountability throughout the network, and may in fact increase the individual participant's trust in the platform's ability to operate efficiently (Eckhardt and Bardhi 2015). Trust in the sharing application is, to some extent, trust in its population of users, in their collective use of the platform, and in the functioning and logic of the whole system (Germann Molz 2013; Sun et al. 2015).

Facilitating Collectivity

Most perspectives represented in the literature highlighted community-building, or some sense of social collectivization, as an important function of SE platforms (Barnes and Mattsson 2016; Sutherland and Jarrahi 2017). By serving as venues for community interactions and participation in larger social movements, SE mediators draw new users, facilitate connections between people, and encourage trust and participation (Moser, Resnick, and Schoenebeck 2017), thereby making the network of resources and social capital more robust (Yuan et al. 2018). Having a sense of community improves participation in SE platforms (Pee, Koh, and Goh 2018), and, reciprocally, participating improves one's sense of community (Albinsson and Perera 2012). Furthermore, a number of studies have found that many users participate in SE systems primarily because they enjoy interacting with others, and contributing to the community(Möhlmann and Zalmanson 2017; Germann Molz 2013). The motivations participants

have for using SE platforms are closely tied to the apparent contradiction between the SE as a utilitarian, profit-driven phenomenon versus an altruistic, community-driven one. Both community involvement and economic gain are significant motivators for SE participants (Hamari, Sjöklint, and Ukkonen 2016; Bellotti et al. 2014). Bucher et al. (2016) suggest that there are in fact separate groups of sharing-oriented participants, and commercially-oriented participants, but that even for commercially-oriented participants sociability and volunteerism are important factors. Even on platforms which support minimal community interactions, such as Mechanical Turk, workers identify their work as a form of social contribution (Kost, Fieseler, and Wong 2018).

SE platforms might build off of existing social groups or community initiatives in order to establish a robust process of mediation (Barnes and Mattsson 2016). Sharetribe, for instance, a platform for hosting sharing marketplaces, allows a localized community to set up their own exchange website. In this way, the platform extends by replicating into each community context, rather than aggregating a global, impersonal network (Hamari 2013; Frenken 2017). On platforms, which operate locally, the socioeconomic status and social capital present within local communities or neighborhoods influences participants' willingness to connect with others, and the potential effectiveness of those connections (Dillahunt and Malone 2015). Even in geographically dispersed communities, shared purpose or lifestyles may shape the use and configuration of SE platforms (Sutherland and Jarrahi 2017; L. C. Irani and Silberman 2013). Scaraboto (2015) describes the controversial emergence of a centralized platform in the geocaching community, and the tensions which developed between community-driven collaboration and centralized platform mediation. In these cases, the protocols of digital mediation are entangled in larger social antecedents, such as communally-held interests, competencies, or prejudices.

Collectivity also takes the form of a number of ideological notions, which are premised on the perceived benefits of the platform technology. Notions of sustainability, for instance, often point to the efficiency of the SE in mobilizing underutilized resources, and in encouraging access over ownership (Martin 2016; Heinrichs 2013; Eckhardt and Bardhi 2015). This is associated with movements towards "anti-consumption," or "mindful consumption" (Philip, Ozanne, and W. Ballantine 2015; Albinsson and Perera 2012; Seegebarth et al. 2016). In the way that these values are promoted, there is a strong sense that, through platforms and specific digital features like badge systems; people can be encouraged to participate in community-friendly ways, or for progressive causes (Richardson 2015). Along these lines the SE is promoted as a way of collaborating for collective good. Another promoted effect of the platform is that, by connecting participants directly to each other, the platform can promote non-hierarchical community structure, returning agency to the individual consumer or community member, and bypassing large, central players (Botsman and Rogers 2010; Carroll and Bellotti 2015a). Perhaps extending from this idea are a number of optimistic and sometimes utopian projections of self-governance, bottom-up organizing, and a "citizen-led future" (Frenken 2017; Kenney and Zysman 2016). These various performances of the ideology of the sharing economy have drawn interest primarily from researchers in marketing and environmental studies. The common assumption behind these perspectives is that, by operating as a connective digital space, the SE is mobilizing new ways of participating in a community.

Digital Mediation in the Sharing Economy

As we elaborate in the discussion, much of the literature considered in this review ignores or assumes the role of technology. The affordances presented above outline these assumptions as well as more sociotechnical treatments of the SE, and present a foundation for developing our understanding of SE platforms as sociotechnical systems.

These affordances are not discussed as independent features but rather as interacting dynamics. The process of match-making, for instance, relies heavily on systems of reputation and trust-building (Ert, Fleischer, and Magen 2016; Gamito 2016). Similarly, trust is closely associated with a sense of collectivity and the security of the platforms transaction management (Gheitasy et al. 2014; Huurne et al. 2017). The model should not be applied in a holistic fashion to every SE platform. Rather, different affordances are more evident in different platforms. In addition, as noted previously, these affordances might be accomplished across a number of separate, but interoperable platforms.

Table 4 shows the percentage of papers in each of the top five categories that mentioned each affordance, showing some variation in the focus of different research areas. Generating flexibility and facilitating collectivity had slightly more attention that the other affordances, which follows the most advertised aspects of the SE: flexibility of use and shared resources. The business and economics literature had a strong focus on flexibility both as a competitive advantage of the SE business model, and as a primary ramification of the SE on the nature of labor. Computer science and engineering research showed a strong interest in transaction management, as many papers in that category were interested in the interfaces and workspaces provided in microtasking environments, as well as the processing resources provided by SE systems more generally. For instance, research focused on optimizing routing algorithms for ridehailing services were coded as transaction management. Much of the research in environmental science was interested in sustainability as an ideological driver of the SE, contributing to its focus on facilitating collectivity.

	generating flexibility	match-making	extending reach	transaction management	trust	facilitating collectivity	total
all publications	152 (34.94%)	112 (25.75%)	128 (29.43%)	115 (26.44%)	93 (21.38%)	140 (32.18%)	435
Business & Economics	65 (42.21%)	49 (31.82%)	42 (27.27%)	30 (19.48%)	36 (23.38%)	55 (35.71%)	154
Computer Science	28 (23.73%)	29 (24.58%)	38 (32.20%)	52 (44.07%)	26 (22.03%)	24 (20.34%)	118
Engineering	18 (25.00%)	9 (12.50%)	20 (27.78%)	31 (43.06%)	9 (12.50%)	17 (23.61%)	72
Environmental Sciences & Ecology	10 (22.73%)	9 (20.45%)	12 (27.27%)	8 (18.18%)	7 (15.91%)	24 (54.55%)	44
Social Sciences	7 (19.44%)	16 (44.44%)	13 (36.11%)	2 (5.56%)	12 (33.33%)	11 (30.56%)	36

Table 5: Discussion of affordances by research topic, showing only the top five topics.

Although the discussion of these affordances varies depending on the perspectives of the researcher, there are common themes. Firstly, the sharing economy system is reliant on scale, and on the processing power of computational and network-based systems. Being able to match people together on demand requires a large population of users as well as appropriate digital infrastructures. Therefore, digital technologies are a critical aspect of this process, both as an interface for participants to connect to the service, and also as information processors. This is a base foundation for the efficiency and flexibility provided by the SE platform. Most analyses in fact center around the SE platform's computational components, the efficiency of its algorithm, and the digital spaces it provides. Rating systems and matching algorithms are central features in the platform's success as a business model, and as a mechanism for social change.

DISCUSSION

The affordances above present a number of essential benefits or concerns presented by mediating platforms, and go some way towards explaining the critical roles played by digital technologies in the success that SE businesses and communities have accomplished in recent years. However, studies of SE platforms have largely focused on centralized SE contexts, glossing over more distributed contexts of sharing. In addition, there is still also some gap in our understanding of technological mediation in SE in that SE research has provided insight into technological results (affordances) but falls short of conceptualizing the technology itself. In the remainder of this article, we discuss different perspectives on the interplay between SE and digital platforms along two dimensions: 1) the organizing model of SE, and 2) how SE is conceptualized as mediating technology. We then turn to gaps in the literature along these two dimensions, and provide directions for future research.

Organizing Models of the Sharing Economy

Concerning the central concept of digital mediation, two fundamental poles of SE organizing models emerge from the literature: a model of centralized, streamlined intervention, and a model of more decentralized, emergent interactions. The tension between centralized control and the decentralized agency of participants has been presented as an organizing paradigm for the SE from a number of perspectives. Ertz, Durif, and Arcand (2016), for instance, organize various instances of the sharing and collaborative economies based on the agency they give to distributed actors. Similarly, Frenken (2017) divides futures of the SE between central, state or corporate control, and a bottom-up cooperativism. We apply this concept to the issue of digital mediation by evaluating the SE platform in terms of the control it assumes over various aspects of exchange. We use the affordances described earlier, and discuss this notion below by outlining two extremes of centralization and decentralization. We then point out some benefits of this framework, and some gaps in the literature it brings to the fore.

The centralized model of SE mediation typically leverages comprehensive automation in order to optimize the convenience, speed, and seamlessness of digital interactions. The centralized platform has a strong presence in the exchanges between participants. It assigns matches, handles payments, and provides tools to help in the completion of the task. A key lesson from the wealth of research on Uber and Mechanical Turk is that a centralized platform can influence participant interactions, and incentivize participants with features like gamification or surge pricing (Rosenblat and Stark 2016; Spreitzer, Cameron, and Garrett 2017). Platforms also actively surveil participants, either through user-provided ratings or through direct data collection, in order to ensure quality (Deng, Joshi, and Galliers 2016; Kuhn and Maleki 2017). Through these interventions, the centralized mediator becomes an authoritative presence; it arbitrates issues of fairness, payment, security, management, and pricing. Exchanges, which occur within the centralized platform are closely chaperoned, and conform to standardized protocols embodied in the materialities and policies of the mediating platform. In some cases, as with Mechanical Turk, the platform provides no means for interactions between workers, seeking instead to focus on direct management of isolated workers (Lehdonvirta 2016; Alkhatib, Bernstein, and Levi 2017). Issues of control, surveillance, and algorithmic management are therefore central foci in the research on centralized platforms (M. K. Lee et al. 2015; Einav, Farronato, and Levin 2016; Ravenelle 2017).

In contrast to this image of the top-down, centralized mediator, a decentralized mediator exercises little control for exchanges beyond match-making, but instead leverages the resources and innovation of its population of users. The most minimal examples of the decentralized platform provide match-making services, or some manner of profile or posting method, which allows users to connect and evaluate each other. However, participants are responsible for negotiating and executing their own transactions (Sutherland and Jarrahi 2017). A large portion of trust-building may be left to the discretion of the users (Liu et al. 2018), or drawn from existing social structures, such as a neighborhood or town. This is the case with timebanking applications, and platforms like Sharetribe, which develop robust networks of exchange around localized communities (Yuan et al. 2018). Furthermore, the mediator relies less heavily on quantifications drawn from rating algorithms, and more on high-throughput channels of communication, such as messages, profiles or in-person meetings, which put participants in contact with one another. In this process exchanges benefit from, and contribute to, a community. Building off of the early examples of Craig's List and Couchsurfing, these platforms, including Freecycle and Freegle, tend to be non-profit-driven ventures. The studies that have examined this model have focused on its bottom-up quality, and on its success or failure at living up to the rhetoric of altruism, sustainability, and egalitarianism, which surrounds the SE (Frenken 2017; Kenney and Zysman 2016; Seegebarth et al. 2016; Martin 2016). However, only a few studies have focused on the embedding of technology in these more distributed sharing networks (e.g. Carroll and Bellotti 2015a; A. Lampinen, Huotari, and Cheshire 2015).

These two models should not been seen as drawing a one-dimensional continuum, as mediators might employ different aspects of centralization and decentralization variably. A platform may assign users to each other through an opaque algorithm, and handle all monetary transactions, but benefit from community relations participants build on external social media

platforms or through in-person interactions. The affordances described above provide dimensions along which we outline a model of mediation. Figure 3 displays these variations, and provides some platform features that may be mobilized in support of centralization or decentralization. In this model, centralization is a holistic effect, and although these affordances are not independent of each other, aspects of centralized control might be taken up variably, according to a platform's business proposition, or according to the negotiations of an initializing community.

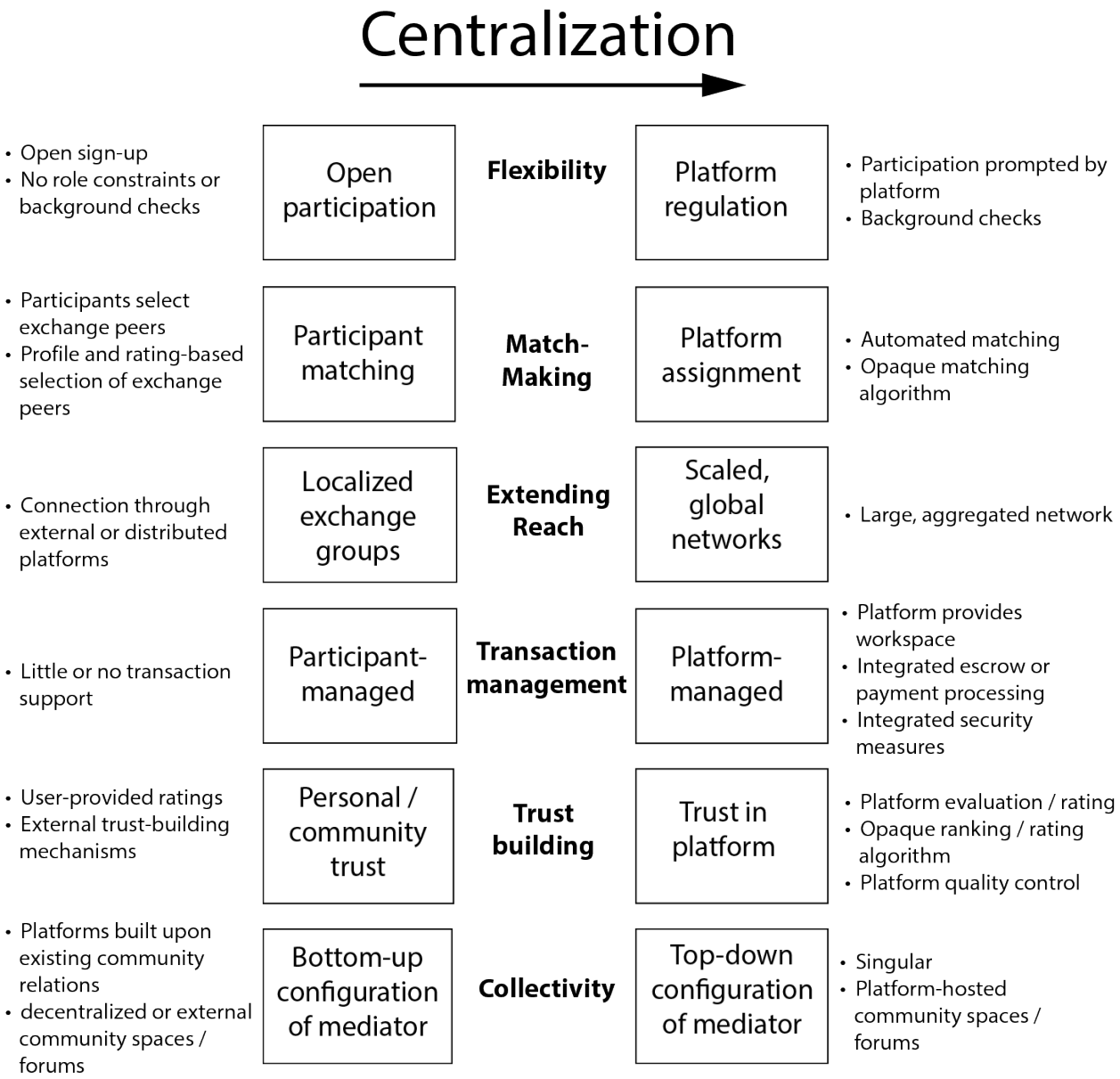

Figure 3: Dimensions of centralization in Sharing Economy mediators

A prominent gap in the literature is the lack of research on the decentralized model. As noted in the findings section, the current literature on the SE has a strong focus on the centralized platform model, and on Uber in particular. Both Uber and Airbnb, the most commonly studied

platforms, exhibit similar qualities: a centralized, profit-driven intermediary, and extensive automation of user interactions. These platforms exemplify the values of efficiency-through-networking associated with the SE, and the notion of 'uberization' has become a catch-all for describing the trend towards SE platform business models. However, these platforms are not representative of the more socially-embedded, community-oriented aspects of the SE. As Eckhardt and Bardhi (2015) pointed out, Uber does not really support sharing so much as paid access to a driver. Furthermore, Uber does not accurately embody the concept of bottom-up organizing that is commonly associated with other forms of the SE, as the application itself controls much of the process of managing users (Simonite 2015). Despite the huge variety of fields interested in the concept of the SE, research remains highly concentrated on a narrow empirical base, and it is from this empirical base that we have gathered our current understanding of the SE. The decentralized platform may harbor modes of mediation, which differ from this prevailing and typical concept of the SE, and is therefore a promising area for future research on digital mediation and SE.

The relative decentralization of a given system is also in part a matter of the investigator's perspective. A common approach in the literature covered in this review was to consider a platform, or a small set of platforms, and evaluate the way participants interacted with the platform's affordances. Even when considering broader societal ramifications, the trend is to draw these ramifications from participants' observed interactions with individual platforms. It does not consider the broader activities of participants, however, as with ridesharing drivers, for instance, switching between Uber and Lyft in order to get the best fares at a given time, or extend their reach to a larger potential network of riders. A few papers have looked at how SE participants operate between and across platforms in the context of micro-task workers (Sarasua and Thimm 2013), digital nomadic workers (Sutherland and Jarrahi 2017), and the geocaching community (Scaraboto 2015). Looking outside the boundaries of the single dominant platform in this way allows for more decentralized processes of mediation to emerge. Given the importance of collective action in the SE, this is an important aspect of the phenomenon to explore.

Conceptualization of Mediating Technology

The SE literature is highly diverse in the ways that it deals with technology. However, given the diversity of research disciplines, the words 'technology' or 'platform' were used to refer to a variety of different things. These different treatments of technology follow some common conceptions which have pervaded the study of IT for years, and we found that they can be effectively differentiated using well-established typologies extended from Orlikowski and Iacono (2001) and others (Akhlaghpour et al. 2013; P. Zhang, Scialdone, and Min-Chun 2011). Table 4 shows a breakdown of these types with examples, and we investigate each below. They include the treatment of technology nominally, as a computational process, as a tool, in terms of proxy concepts, and as a sociotechnical ensemble.

The two most common perspectives on SE technology were to treat it as computation, or as a purpose-driven tool. In the computational perspective, researchers either considered the underlying algorithms and application features of technology (Masoud and Jayakrishnan 2017),

or considered the larger economic situation and effects of the SE through mathematical modeling. Weber (2014), for instance, describes SE mediation dynamics through a mathematical pricing model. In a similar fashion, the tool perspective considered the SE platform as a predictable implement, which, once designed, can be used to accomplish a goal fairly reliably. Primarily, the SE platform was considered as a tool for altering social relations, changing the dynamic between workers and clients, or between consumers and large intermediaries (e.g. Puschmann and Alt 2016). In other treatments, especially those discussing transaction management, the SE platform is described as a tool for enhancing productivity. This is especially prevalent in the micro-task literature, where worker productivity and quality are treated as designable, optimize-able functions of the platform's task environment and interface (e.g. Krishna et al. 2016; Cai, Iqbal, and Teevan 2016).

The proxy perspective describes situations in which technology is discussed in other terms, the terms used standing in as a proxy for the technology itself. In the SE context, the two primary proxies adopted were perceptions, meaning people's interpretations of certain platform features or the platform itself, and diffusion, meaning the rate of adoption or growth of SE platform populations. Studies, which looked at participant perceptions, were typically concerned with the platform's perceived benefits, such as economic benefit, and benefits for sustainability (Bucher, Fieseler, and Lutz 2016; e.g. Hamari, Sjöklint, and Ukkonen 2016). Diffusion proxies did not consider perceptions of SE platforms and their perceived benefits, but rather their actual diffusion among populations of users, and the competitive growth platform technology lent to SE businesses over traditional business models (Zervas, Proserpio, and Byers 2014).

The ensemble perspective described mediating technology as being embedded in larger social contexts (Nelson, Jarrahi, and Thomson 2017), such as sustainability movements, economic ideologies, or professional labor cultures. The ensemble view has particular usefulness for a perspective which Dillahunt et al. (2017) describes as "socio-technical design". This perspective considers the user, and treats technologies as socially embedded systems, whose role and meaning emerge in use (Gheitasy et al. 2014; L. Irani 2015; A. M. I. Lampinen 2014). For instance, Lampinen et al. (2015) look at how the attempt to develop a digitally-supported single parents network became mired in the demographics and lifestyles of the population of participants. Another, more macro perspective views the political and economic tensions and alliances in which technologies come to be implemented and legitimized (Martin, Upham, and Klapper 2017; Frenken 2017). Of special interest to this perspective is the potential of the SE platform to promote new political and economic structures, and its consequences for sustainability in particular. Both of these perspectives make use of the ensemble view of technology in order to examine technologies *in use*.

Perspective on technology	%	Description	Examples
Unaddressed or Nominal	42.52%	Technology is not discussed, or simply referenced as technology, without any distinct characteristics.	(e.g. M. Zhang et al. 2016; Lisson et al. 2016; X. Cheng, Fu, and de Vreede 2018)
Computational	11.26%	Technology is a process, discussed as a algorithmic or mathematical model, which improves efficiency or performance.	(e.g. Weber 2014; Masoud and Jayakrishnan 2017; Cai, Iqbal, and Teevan 2016)
Tool	11.95%	Technology is a mechanism, which can be applied to a specific problem and reliably produces results, such as increased productivity, or altered social relations.	(e.g. Krishna et al. 2016; Cai, Iqbal, and Teevan 2016)
Proxy	26.44%	Technology is represented by some surrogate value, including the breadth or economic impact of adoption.	(e.g. Hamari, Sjöklint, and Ukkonen 2016; Bucher, Fieseler, and Lutz 2016; Zervas, Proserpio, and Byers 2014; Piscicelli, Cooper, and Fisher 2015)
Ensemble	7.82%	Technology is an ensemble of technical artifacts, policies, and cultures of use, and the capability or skill to leverage them.	(e.g. A. Lampinen, Huotari, and Cheshire 2015; L. Irani 2015; Frenken 2017)

Table 6: Research perspectives on technology.

The results of coding the papers shows that little of the existing research engages with the SE's underlying technological components, either in a computational or sociotechnical way. While it is possible for us to infer how technology provides benefits to various parties and creates affordances such as those noted earlier, most of the work on the SE does not problematize the

technology itself, or its unique interactions with existing norms, cultures or other important contextual elements. On a more minute scale, current approaches do not investigate how affordances of the platform emerge from the interaction between specific materialities (or the intentions and interests of platform owners inscribed in the platform functioning) and the social dynamics of the sharing context such as conflicting interests of the participants.

The SE platform presents the researcher with a number of obstacles which could be overcome by drawing on analytical tools which have been developed in the literature on large-scale information technologies, specifically platform studies (e.g. Tiwana 2015; Gawer 2014; Plantin et al. 2016) and information infrastructures (e.g. Hanseth and Lyytinen 2010; Henfridsson and Bygstad 2013). The first of these obstacles is establishing the appropriate scope for capturing the scale and heterogeneity of platform systems (de Reuver, Sørensen, and Basole 2017). SE mediation involves coordination at a scale much larger than that of the traditional information system, and may involve a heterogeneous array of applications and platforms. In particular, existing conceptualization of dynamics of large-scale systems, and their modular parts (e.g., Hanseth and Lyytinen 2010; Tiwana, Konsynski, and Bush 2010) can be useful for examining the nature and role of digital platforms in SE. Furthermore, a developing topic in the platform studies literature is the centralization of control around a few profit-driven platforms like Google and Facebook (Plantin et al. 2016). This could inform a similar discussion, which is developing in the SE literature around centralized SE platforms.

A second issue in studying the nature of SE platforms is conceptualizing the tension between control and generativity that these technologies may bring about. Managing a huge network of consumers and producers is one of the primary facilities of the SE platform, accomplished through a complex negotiation between a population of participants and the materialities of the platform's algorithms and policies. There have been a number of meticulous studies of the tension between central control and user generativity in both the platform and information infrastructure context (Ghazawneh and Henfridsson 2013; Spagnoletti, Resca, and Lee 2015; Tilson, Sorensen, and Lyytinen 2012). Drawing on these literatures would provide a developed theoretical vocabulary for the ongoing debates surrounding the SE and technological mediation: improving the design of technologies, informing regulation, and providing a better understanding of the societal implications, utopian and dystopian, which have been projected ahead of the SE's rapid development.

CONCLUSION

The literature on the SE is recent: much of the work being done on this topic is still exploratory, and definitions are still emerging. Beyond a certain preoccupation with centralized, profit-driven systems like Uber, the technologies studied under the Sharing Economy vary significantly, from ride-sharing services to distributed currencies to freelancing platforms. Research perspectives are similarly varied, including tourism, governance, design, and digital gig work. However, there are some commonalities in the ways that SE businesses and communities have grown up around platform systems, and the research, though varied, has identified some common,

underlying promises (or ramifications) of the SE. The motivation for this paper was to delineate these commonalities as they relate to the role of technology.

Additionally, we find that perspectives on technology, and more importantly the sociotechnical perspective, are currently lacking in the research on the SE. There is a significant amount of research on the SE as a business model, and the computer science literature has engaged SE applications (and to a certain extent platforms) as optimizable tools. However, the economic, and social aspects of the SE have not been satisfactorily drawn together into an integrated, sociotechnical understanding of the technological element of the SE. The use of digital platforms for peer-like exchanges, even in anonymous or semi-anonymous contexts, represents a new way of making and leveraging interpersonal connections, as well as a new way of participating in social groups. In order to understand these changes, and in order to inform the design of SE technologies, it is necessary to understand the SE as a sphere of technologies, workers, consumers, altruistic participants, governors, and developers. The future of research in this area must bring together social, economic, and technological research in order to provide a more holistic understanding of the SE.

The synthesis provided in this review serves as a foundation for more directed research on the technological components of the SE. We have provided an analysis of emerging views on SE technologies and organized them around a theme which has developed in the literature. This theme focuses on the agency that platform features, such as algorithms and rating systems, take in conducting transactions or sharing exchanges, versus the amount that is left to participants. Using this distinction, we can draw a continuum between centralized platforms, which automate and take control of exchanges, and decentralized platforms, which rely on the activity and discretion of participants to conduct their own exchanges. The value of this contribution is to establish a common frame of discussion, within which the research that has been done on centralized platforms can inform the work that is being done on decentralized platforms, and vice versa. In this way, the concept of mediation, centralized or decentralized, can provide a central space for future discussions of the SE.

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