

RESEARCH



# Making Order in Household Accounting - Digital Invoices as Domestic Work Artifacts

Erik Dethier<sup>\*1</sup>, Dean-Robin Kern<sup>2</sup>, Gunnar Stevens<sup>2</sup> & Alexander Boden<sup>1</sup>

<sup>\*1</sup>Department of Management Sciences, Bonn-Rhein-Sieg University of Applied Sciences, 53757 Sankt Augustin, Germany (E-mail: erik.dethier@h-brs.de; E-mail: alexander.boden@h-brs.de);

<sup>2</sup>Digital Consumer Studies, University of Siegen, 57068 Siegen, Germany (E-mail: dean-robin.kern@uni-siegen.de; E-mail: gunnar.stevens@uni-siegen.de)

Accepted: 22 February 2024

**Abstract.** The digitization of financial activities in consumers' lives is increasing, and the digitalization of invoicing processes is expected to play a significant role, although this area is not well understood regarding the private sector. Human-Computer Interaction (HCI) and Computer Supported Cooperative Work (CSCW) research have a long history of analyzing the socio-material and temporal aspects of work practices that are relevant for the domestic domain. The socio-material structuring of invoicing work and the working styles of consumers must be considered when designing effective consumer support systems. In this ethnomethodologically-informed, design-oriented interview study, we followed 17 consumers in their daily practices of dealing with invoices to make the invisible administrative work involved in this process visible. We identified and described the meaningful artifacts that were used in a spatial-temporal process within various storage locations such as input, reminding, intermediate (for postponing cases) buffers, and archive systems. Furthermore, we identified three different working styles that consumers exhibited: direct completion, at the next opportunity, and postpone as far as possible. This study contributes to our understanding of household economics and domestic workplace studies in the tradition of CSCW and has implications for the design of electronic invoicing systems.

**Keywords:** Domestic workplace studies, Consumer informatics, Empirical study, Household management, Accounting practices, Financial practices, Administrative work

## 1 Introduction

*'My wife doesn't work.'*

Tired of such male sayings, one overarching theme of the early feminist movement was to overcome the notion that domestic life was a private, relaxing, entertaining, and apolitical affair (Hayden 1982). Instead, right from the beginning, material feminism has drawn attention to the fact that a multitude of obligations,

unpaid work, and unequal distribution of labor characterize the domestic context (Hayden 1982; Hochschild 1989; Mederer 1993).

In the history of feminism, two non-mutual calls to action emerged. The first emphasizes the need to redefine gender roles, advocating for greater male participation in household chores (Friedan 1963). The second one emphasizes the need to redefine the working conditions, focusing on improving the work environment and processes (Frederick 1921; Gilbreth 1927). Both demands, while separate, share a common goal: to rectify long-standing injustices in domestic labor dynamics.

Moreover, both movements recognized the importance of making household labor visible (Daminger 2019; Dean et al. 2022; Hochschild 1989). In contrast to professional work, domestic work at home lacks any legally binding contract, a clear job description, formal training, prescribed rules for work execution, and well-specified process models. Instead, domestic work is self-organized organically by its very nature; people design their practices, learn by enculturation, use guidebooks and online tutorials, or adapt knowledge from professional contexts.

These long-standing demands of feminism are still valid today, even if the forms of domestic work have changed over time. When household appliances such as washing machines, kitchen appliances, or vacuum cleaners were not yet widespread, the primary focus was physical labor, such as cooking or cleaning (Frederick 1921). In the 1950s, the view broadened, stressing that caring is not the naturally given passion of a woman but unpaid and unequally distributed household work (DeVault 1991). Today's feminists, such as Daminger (2019) or Emens (2021), further insist that domestic administration activities such as paperwork and managing contracts are serious as this kind of work is time-consuming. It is mentally, emotionally, and psychologically stressful but often goes unnoticed, unpaid, undervalued, and unequally distributed. People are overwhelmed by such administrative work and cannot comply with it (E. F. Emens 2021), which leads to financial losses and increases the risk of over-indebtedness (Gerrans et al. 2022; Mendoza and Pracejus 1997).

Feminists like Emens (2015) take up the long-standing demand to reduce undesirable administrative household work through efficiency improvements and technology support is an important task. The digitization of administrative processes and special tools such as fileee<sup>1</sup>, anybill<sup>2</sup>, or GetMyInvoices<sup>3</sup> for private record-keeping (Zahedi 2020) offers new opportunities to make domestic work easier but also poses the risk of disrupting established practices. Yet, system design must avoid such 'ideology of the industrialized home' (Rutherford 2010) as too simplistic, ignoring the specifics of the domestic context.

---

<sup>1</sup> <https://www.fileee.com>

<sup>2</sup> <https://anybill.de>

<sup>3</sup> <https://www.getmyinvoices.com/en/>

## Making Order in Household Accounting - Digital Invoices as...

From this perspective, the paper addresses the following research goals:

- Uncovering and making accountable the informal work practices of domestic invoice management to sensitize researchers and designers to the contingencies of domestic work practices and a wide diversity of domestic ordering systems
- Analyzing the effects of the co-existence of digital and electronic documents and how these impact domestic work practices
- Developing some ‘implications for design’ that support domestic work practices beyond a naive rationalization and automatization paradigm

To ‘get a grip’ people’s daily administration work, we adopted a kind of *follow-the-actor* approach (Lawo et al. 2020) and focused on the ‘secret’ life of invoices within the domestic context. Overall, we visited 17 individuals to observe their domestic workplaces and conducted semi-structured interviews to understand their invoicing practices. Reconstructing what people do with invoices in minute detail, we contributed to the outlined research goal by making mundane household accounting visible, observable, and reportable.

This paper’s findings show that invoices are more than just pieces of information. Managing invoices involves checking, processing, archiving, and searching for them for various purposes, such as paying bills, completing tax returns, or receiving customer support. Invoices are essential artifacts that structure, coordinate, and articulate these domestic work processes. Furthermore, we observed that people have adopted and created various physical and digital systems for organizing and managing their invoices. These ordering systems (Schmidt and Wagner 2004) are part of the many working styles and practices used to distribute and coordinate invoicing work among household members.

Our findings contribute to understanding household economics (Cécora 1991; Molina 2011) and research on the domestic workplace (Doling and Arundel 2022; Kooreman and Wunderink 1996). In particular, our findings demonstrate that thirty-year-old literature on paperwork (Sellen and Harper 2003) in CSCW is still relevant and must be taken into account by electronic invoice standardization initiatives (Swathi et al. 2020) as well as the design of domestic document systems.

## 2 Related Work

### 2.1 Making domestic work visible

Domestic work refers to the tasks and responsibilities performed within a household to ensure its functioning. It encompasses a wide range of activities, including procurement and sourcing, repairing and maintenance of the living environment, cooking and cleaning, parenting and caring (DeVault 1987; Hochschild 1989; Mederer 1993), but also administrative and financial activities such as household accounting and financial

management (Antonides 2015; Piorkowsky 2000), the paperwork at home (Taylor and Swan 2005; Vyas et al. 2016), consumer's vendor relationship and contract management (Alvarez 2017; Searls 2012), or the cognitive and mental work of household management (Daminger 2019; Offer 2014; Walzer 1996).

Feminist scholars were among the first to point out that the home presents a hidden economy, where housework has no price but value (Daniels 1987; Duque and Carlos 2021; Illich 1980; Primeau 1992). They also were the first to document how this work is not just unpaid but also unequally distributed among family members (Baxter and Tai 2016; Bittman and Wajcman 2000; Ciciolla and Luthar 2019; DeVault 1991; Schneider and Hastings 2017). The unequal distribution of labor has long been recognized regarding physical-oriented housework (such as cooking and cleaning) and emotional-social housework (such as caring and parenting). Recent studies, however, indicate that this inequity holds for mental-administrative household work as well (Daminger 2019; E. F. Emens 2015; Hochschild 1989; Mederer 1993) although the difference seems smaller in this case (U.S. Department of Labor 2023).

The literature often uses time-use and time-budget surveys to highlight the inequality of housework. These surveys ask participants how much time they spent on a specific activity in the past, or the 'time diary' approach asks what activity they performed over a given time (Birch et al. 2009; BLS 2022; Hurst 2015). Often researchers use public national or cross-national time-budget surveys, such as the Australian Time Use Survey, the Multinational Time Use Study (MTUS), the Harmonized European Time Use Survey (HETUS), or the most popular American Time Use Survey (ATUS) (Anxo et al. 2011; Craig and Powell 2018; Krantz-Kent 2009; Moreno-Colom 2017; Möser 2010; Winkler and Ireland 2009). Grouping various ATUS categories, Winkler and Ireland (2009) estimate that US citizens spent about 1.64 hours per week on household management. In contrast, the US Government (2015), estimated that the paperwork burden generated by legal issues to be 9.43 billion hours in 2014, which is higher than expected by the ATUS data.

Various authors criticize time budget surveys because they underestimate cognitive domestic work as they are typically performed in parallel with other activities (E. F. Emens 2015; Winkler and Ireland 2009). The numbers also do not capture the subjective dimension of time use, the meaning of activities, the perceived work quality, and the physiological and cognitive cost of household work (Habib et al. 2010; Moreno-Colom 2017). Concerning two objectives, fair work distribution and improved working conditions, time-budget studies are helpful only for the former, as they quantify temporal inequalities. However, the latter requires methods to make the natural orderliness and structuring of the situated work accountable (Crabtree et al. 2000).

This requirement entails a deeper engagement with the nature of accounting. For this reason, we give an overview of accounting research in general

and household accounting in particular. We also delve into business accounting because household and business accounting are structurally connected (Luhmann 2005). For example, private households must react to the payment procedures of companies. Moreover, invoices, although key artifacts in household accounting, are generated and defined by the business accounting processes and systems. Since the research on administrative housework benefits much from the workplace studies on office work in CSCW (Rouncefield et al. 1994; Tolmie et al. 2002), we summarize the findings of this branch of research, which are relevant to our work.

## 2.2 Accounting research

Accounting has a long history as a research field. It is a practice used by individuals, organizations, and governments to measure and make economic issues visible (Glautier and Underdown 2001). Garfinkel pointed out accounting involves practical actions of making order (Heritage 2013). Accounting does not simply describe reality but actively constructs it (Morgan 1988). The categories used in accounting are not neutral but rather the result of political negotiation (Suchman 1993).

### 2.2.1 Business accounting

Business accounting aims to improve the efficiency of organizational financial activities and make them reportable (Libby et al. 2017). Modern business accounting is based on accounting systems, which are typically constantly evolving legacy systems (M. P. Gupta and Bhatia 2005). These systems represent the organizational memory of the company, which should keep financial records for a minimum of five (preferably seven) years (Clarke and Wilson 2018). The retention period is defined by internal business policies but also by legal obligations. A business should file accounting records logically and systematically to facilitate information retrieval (Clarke and Wilson 2018).

Document management and business accounting systems have mainly studied process automatization (M. P. Gupta and Bhatia 2005). Yet, ethnographic studies on record keeping point to the materiality of record keeping and the contribution of records and archives for the aggregation and production of knowledge (K. Shankar 2004). Record keeping presents a practice across various domains (Al-Omar and Cox 2013; Balogh et al. 2022; McKemmish and Gilliland 2013), where it is vital to investigate multiple record types, immaterialities, competencies, and practices (K. Shankar 2004).

A key record of business accounting is the invoice. Following Webster's Dictionary (1913), an invoice is "*a written account of the particulars of merchandise shipped or sent to a purchaser, consignee, factor, etc., with the value or prices and charges annexed*". One can trace the history of such accounts back to the use of clay 'tokens' in early societies, such as Mesopotamia, which

used tokens for counting and for keeping records of accounting transactions (Yeo 2021). In modern business accounting, invoices act as ‘a record of the work that has been done to it [... where] learning how to work with an invoice means learning the labor associated with paperwork’ (Anderson and Sharrock 1992). Related to this, various types of invoices are relevant, such as commercial or tax invoices, and one must handle these invoices differently depending on whether the transaction is based on a credit purchase or a credit sale (Clarke and Wilson 2018). For ordering purposes, the invoice number is crucial as it serves as a reference code to map electronic funds transfers to a particular transaction and track the state of the transaction (e.g., if the goods are delivered, are paid, etc.). The purpose is to keep all records of a particular transaction together and systematically archive them (Clarke and Wilson 2018).

In the business-to-consumer (B2C) sector, there are significant efforts to automate the paper-based invoicing process (C. B. M. Gupta 2020; Španić et al. 2011), such as the standardization of the message exchange between companies using EDIFACT (Electronic Data Interchange for Administration, Commerce, and Transport) or Electronic Data Interface (EDI) (Deshmukh 2006). In Germany, there is an increasing interest in the electronic invoices format “ZUGFeRD”. This format includes the invoice data as an embedded structured XML in a PDF/A-3 format, supporting both machine-readability and human-readability. A Franco-German standard for electronic invoices, Factur-X 1.0. UN/CEFACT CII (United Nations Center for Trade Facilitation and Electronic Business Cross-Industry Invoice), presents international standards for electronic invoice exchange.

Due to their complexity and cost, it is common for organizations to send invoices via email as PDFs or by scanning and emailing them with printed copies to their customers. (C. B. M. Gupta 2020). Such a lightweight concept of the electronic invoice has also gained popularity in the B2C segment, where companies such as Amazon, eBay, Netflix, Spotify, and others do not send paper-based invoices but only electronic ones via email or through apps and web portals. The following section discusses how a change in organizational practices also affects the domestic side. Still, according to Palmer (2022), about 90% of all invoices worldwide are still sent manually. As a result, electronic and paper-based records exist in parallel, where workplace studies in the business context (Rouncefield et al. 1994) show that these semi-digitalized and semi-automated processes influence daily work practices and should be considered by system design.

In summary, business accounting is trending towards digitalization. This trend is driven primarily by the B2B sector but is also increasingly affecting the B2C sector. However, as we know from previous CSCW studies, ill-considered digitization can have unintended consequences for existing work practices (Berndtsson and Normark 1999; Vines et al. 2011). Therefore, we must examine the impact of digitizing invoicing processes in the B2C area on administrative housework more closely to avoid harmful effects.

### 2.2.2 *Household Accounting*

Household accounting encompasses various activities, such as expense budgeting, money saving, bookkeeping, contract management, calculation, and monitoring of personal and familial net worth (Walker 2008).

Household accounting has mainly been studied in home economics. Authors like Langhojer (2009), Pankow et al. (1991), and Piorkowsky (2000) studied accounting work concerning expense tracking books for household accounting together with usage recommendations. These solutions typically adopt professional business accounting concepts but aim to provide less complex tools that give consumers a basic budget overview (Hoque 2006). Similarly, Hawkins and Bischoff (2003) have suggested five simple techniques for financial management at home: the receipt method, where all invoices are sorted into categories and collected in a box or drawer; the envelope system, where envelopes are labeled with different categories and filled with the planned amount of money to be spent; the calendar or notebook method, where incomes and expenses are listed under the corresponding categories; the checkbook method, where expenses are tracked in a checkbook, including the date, check number, amount, and a note of the spending category; and use of a computer system.

There is also a market for textbooks and practical guidelines that teach skills valuable for domestic tasks (Haskins 1903; Hoque 2006; Langhojer 2009; Piorkowsky 2000), as well as software tools such as Quicken or Mint.com that support people in bookkeeping, cash flow analysis, and budget planning. Yet, most of the guidelines and software solutions seem to fail in practice. For instance, a survey in Germany shows that only 27% of households kept regular accounting records (Piorkowsky 2000). This finding is consistent with empirical studies conducted in the domestic context (Harper and Shatwell 2002; Kaye et al. 2014; 2016), showing that many people use self-developed bookkeeping systems based on pen and pencil, Google Drive, or self-created Excel sheets.

Walker (2008) points to a vital factor contributing to the practical irrelevance of home economics approaches is their orientation on the homo economicus and 'virtuous practices to take the emotion out of domestic money matters' (Walker 2008). Similarly, Kaye et al. (2014) argue that such rational principles misguide design efforts. Instead, they stressed that dealing with money is not a purely factual, rational administrative act but is accompanied by many emotions, like annoyance, anger, safety, shame, pride, etc.

Feminist research on administrative housework (Daminger 2019; E. F. Emens 2015) and the research on household accounting (Piorkowsky 2000; Walker 2008) have emphasized its work-like nature. However, there are few studies in this area that investigate how administrative work is performed in everyday life. In fact, it is from CSCW research that we can learn in this regard.

### 2.2.3 *Accounting as a mundane practice*

While many studies on home economics have focused on accounting tools in isolation, research in CSCW stresses that we must understand technology as socially embedded (Wulf et al. 2018), where the flow of information does not follow abstract process models, but must be considered as part of a socio-material practice (2017).

Regarding this, invoices are not just pieces of information, but represent the cooperative work between a company and its clients as independent and interdependent actors ‘who interact through changing the state of a common field of work’ (Schmidt and Simonee 1996). In this sense, invoices serve as recognizable artifacts and boundary objects facilitating cooperation (Star and Griesemer 1989). Moreover, invoices are work artifacts within the household, where processing invoices is not just a series of isolated actions, but rather a lifecycle of accounting-related activities.

In the domestic context, people also create accounting systems that involve artifacts, routines, and shared responsibilities among household members (Muske and Winter 2001; Taylor and Swan 2005; Vyas et al. 2016). These domestic accounting systems also address activities with different goals, such as short-term tasks, like paying an invoice, and long-term endeavors, like saving money for a holiday, house, or retirement (Muske and Winter 2001; Vyas et al. 2016). It is also important to note that these activities are not independent, as short-term actions often influence long-term objectives. Compared to the highly standardized and structured business processes, domestic accounting practices are also much less structured (Muske and Winter 2001). Despite their contingency, however, they are not arbitrary. Instead, ‘doing order’ and making domestic routines serve as ‘the glue of domestic life’ (Tolmie et al. 2002).

The ecology of domestic artifacts used for accounting is also related to the concept of ordering systems (2016). As noted by Schmidt and Wagner (2004), ordering systems are constructed and maintained through cooperation. The cooperative nature of human work requires articulation work, which is ‘constituted by the need to restrain the distributed nature of complexly interdependent activities’ (Schmidt and Simonee 1996). Because of the materiality of practice, artifacts reduce the complexity of coordinating activities and supporting articulation work. Specific artifacts articulate distributed activities in a routinized manner. They have a recognizable material structure and common meaning, through which the state of a common field of work is made accountable to the actors involved (Schmidt and Simonee 1996). This view can also be applied to domestic life. For example, Taylor and Swan (2005) studied the use of everyday objects such as calendars, to-do lists, and paper notes as ‘organizing systems’ to support families’ daily routines. Swan et al. (2008) found that these organizing systems are not fixed entities but result from an ongoing effort to maintain an organized home.



## Making Order in Household Accounting - Digital Invoices as...

Making finance-related activities accountable involves various domestic physical and spatial resources (Harper and Shatwell 2002; Vyas et al. 2016). These resources are used to store and display physical and digital financial documents. For example, people place invoices on specific surfaces such as kitchen tables or study room desks (Vyas et al. 2016), or use them as ‘obstacles’ in front of a door (Harper and Shatwell 2002) to remind themselves to deal with them later. Snow and Vyas (2015) further note that consumers have developed paper-based techniques that require little technology to organize the domestic division of labor in the collaborative process of money management. Also, Vyas et al. (2016) found that paper is still a vital artifact in the home, supporting people’s organization of their financial work. For example, paper mail is used to share and broadcast letters within the household and among family members. Paper can ‘oil the wheels’ of an organization, enabling collaboration and communication (Harper and Shatwell 2002).

These domestic accounting practices refer to what Rouncefield et al. (1994) defined as paperwork as a ‘spatial and temporal marker of the progression of work [and generates and encourages] the work process’. Paper-based practices have some unique features, such as the fact that information written on paper is easier to read and discuss cooperatively with others than digital information (Sellen and Harper 2003). In addition, paper offers interactional flexibility, which is why it is still used for certain tasks even after a computer system has digitized the process (Luff et al. 1992). Thus, ‘without paper, organizations would be very different places than they are now’ (Harper and Sellen 1995) because ‘paper and work practices have co-evolved over the years, and changing these long-standing work patterns within existing social, technological, and cultural infrastructures is difficult’ (Sellen and Harper 2003). Regarding the domestic context, Kaye et al. (2014) uncovered that tracking family financial affairs included various paper systems, like index cards, notebooks, datebooks, or labeled folders.

However, paper also has its disadvantages, and its consumption is decreasing (Briscoe 2022). Paper has higher delivery, storage, and retrieval costs than digital-based systems. Additionally, its physical nature limits its use in cases where amendment, revision, or remote access is necessary. However, the goal is not to criticize work practices for the limitations of the medium (Turner 2003), but to understand the related work practices in which paper serves as an information and coordination artifact (Sellen and Harper 2003).

The digitalization of business and household accounting does not present a straightforward evolution, where the new digital version simply replaces ‘analog’ practices. Concerning the domestic context, Muralidhar et al. (2019), for instance, point out that money practices evolve organically through adopting new technologies. However, technology design must respect people’s existing practices and zone of proximal development to enable such co-evolution. Regarding

the trend toward online banking, Vines et al. (2014) stress that digitalization can open new opportunities for these individuals, but there is also the danger of making existing practices impossible. Similarly, Collins et al. (2009) argue that IT could support the money practices of low-income individuals in the US but that we must prevent deepening the digital divide in that context. In this regard, Muralidhar et al. (2018) highlight that people use a mix of paper and digital artifacts to organize their financial affairs. Despite advantages, such as time savings, cost savings, and improved information supply due to digitization, Muralidhar et al. (2018) show that paper-based artifacts are still in use.

In summary, our research questions and approach arise from the interplay of all three research areas: The need to seriously consider housework as a marginalized practice represents a long-standing, feminist demand. While we know from feminist research that this work is unequally distributed, we know less about how people perform this work. The research on business accounting shows that also the B2C sector is becoming increasingly digitized, but without investigating the effects on people's daily life. In this respect, it is the methodological toolkit of CSCW research that can make the mundane work visible and accountable to envision administrative support systems. Next, we outline, how we implement this work program in our empirical study.

### 3 Methodology

#### 3.1 Sampling and Participants

We conduct an ethnomethodologically informed, design-oriented interview study (Crabtree et al. 2000; Rohde et al. 2017) to understand how people use invoices for all practical purposes. We used convenience sampling (Bryant and Charmaz 2010) combined with the snowball method (Helfferrich 2011) to identify interview participants among friends, family members, and university colleagues. We recruited 17 participants from various cities in North Rhine-Westphalia and Rhineland-Palatinate, Germany. Three researchers conducted the interviews between October 2021 and January 2022. Due to COVID-19 restrictions, thirteen interviews were conducted online via videoconferencing, two interviews were conducted in the participants' homes, and two interviews took place in the researchers' office. The interviews lasted between 13 and 47 minutes (average: 36 minutes). In total, we recorded 10.3 hours of audio material. During the interviews, we also took photographs or asked the participants after the interviews to send us photos and screenshots of the records and the places where they buffer or archive them.

The average age of the participants was 38 (range: 21-81), six male and 11 female (see Table 1). Their professional backgrounds were quite diverse: 12 were employed, two were self-employed, two were students, and one was a pensioner.

## Making Order in Household Accounting - Digital Invoices as...

The household type was also diverse (single: three; couple: nine; family: four; community: one). Nearly all participants regularly file tax returns. Two participants have private health insurance, which reflects the national average. In our context, these are relevant pieces of information because tax and insurance have special requirements for transactions to be substantiated by invoices. In Germany, people with private health insurance have more paperwork to do with their insurance company than people with statutory health insurance.

### 3.2 Methods and Setting

We conducted semi-structured interviews asking participants to describe their typical private invoice processing in retrospect and to describe the artifacts they use. We refined our interview guidelines in an iterative manner based on the insights gained from the interviews until we reached theoretical saturation.

During the semi-structured interviews, we initially collected demographic data such as age, number of persons in the household, and profession. After this, we asked participants how they handled invoices. We then asked more specific questions regarding (a) the channels through which they received invoices (e.g., mail, email, shop), (b) their most recent invoices and how they processed them, (c) the relationship they had to that work, (d) and the division of tasks and role models they followed. If possible, we asked participants to demonstrate their practices using their current filing systems or email inboxes. We also inquired about (I) the number of invoices they receive per channel and (II) the average time it took them to process an invoice.

### 3.3 Data Analysis

All interviews were transcribed by the authors using the transcription software Amberscript. In the first step, we used this software to produce transcripts of the interviews. The authors then reviewed and revised the transcripts for accuracy and content to ensure a high level of quality.

In the tradition of ethnomethodologically informed workplace studies (Crabtree et al. 2000), our analytic stance was ‘to describe and explicate in lived detail the practices [...so] that any competent member engages to get the activity done and done again’ (Crabtree et al. 2000).

About this goal, we used thematic analysis (Braun and Clarke 2012) as a tool to identify and represent themes that are relevant to understanding the domestic context. Sensitized by previous research on domestic work and ordering systems, we investigated work artifacts, work procedures, and collaborative efforts as topics of particular interest. We further made use of the ‘following-the-artifact’ as an analytic lens (Lawo et al. 2020), adopting techniques from business process modeling (Salimifard and Wright 2001) to analyze and represent the sequential order of domestic work. We also used the analytic lens from material culture theory

Table 1. Overview of the interviewees and their household situation (Interview form: F2F = on-site interview; VC = video conference).

Name <sup>1</sup>	IF	Age	Gender	Household Type	Profession	Average monthly income [€]	Health insurance
<b>Sophia</b>	VC	21	W	Couple household (two-person)	Student with part time job	450	public
<b>Isabella</b>	VC	21	W	Single; household with 6 persons (Family)	Student without part time job	No income	public
<b>Kim</b>	VC	24	W	Single; single-person household	Student and Medical assistance	450	public
<b>Emma</b>	F2F	24	W	Single; household with 3-4 persons (community)	Research associate	4.400	public
<b>Mia</b>	VC	24	W	Couple household (two-person)	Student without part time job	No income	-
<b>Oliver</b>	VC	26	M	Couple household (two-person)	IT-Product Manager and Financial Advisor	7.500	public
<b>Amelia</b>	VC	27	W	Couple household (two-person)	Research assistant	4.000	public
<b>Noah</b>	VC	28	M	Single; single-person household	Sales Manager	3.000 – 4.000	public
<b>Evelyn</b>	VC	31	W	Couple household (two-person)	Research assistant	1100	public
<b>Olivia</b>	F2F	34	W	Married, a two-person household	Research associate	4.800	public
<b>William</b>	F2F	36	M	Single; single-person household	Research associate	4700	public
<b>Kathy</b>	F2F	38	W	Married; four-person household; two children	Social worker	-	public
<b>Ava</b>	VC	55	W	Married; four-person household; two children	Employer	450	public
<b>James</b>	VC	57	M	Married; three-person household; one child	Insurance company worker	>10.000	private
<b>Charlotte</b>	VC	57	W	Couple household (two-person)	Personal Assistance	3.500 - 4.000	public
<b>Benjamin</b>	VC	61	M	Couple household (two-person)	Financial and investment advisor	7.000 - 9.000	private
<b>Henry</b>	F2F	81	M	Couple household (two-person)	Pensioner	-	public

<sup>1</sup>The names of our participants are pseudonymized.

(Lueger and Froschauer 2022) to view artifacts as materializations of practice, in which knowledge, skills, and meaning crystallize and are analyzed as such.

The transcripts were analyzed independently by two researchers. Photos of domestic materials and places enriched our analysis visually, helping us to understand the materiality of the practices described in the interviews. Afterward, the researchers discussed their respective analyses to resolve any differences. Several joint interpretation workshops (Heinze et al. 2020) discussed interpretations, theme naming, and documentary accounts (such as artifacts) of the work practices. In these sessions, the authors presented their understanding of the context and the work practice to harmonize the analysis and to ensure a common understanding of ‘the lived work of witnessed activities’ (Crabtree et al. 2000) doing administrative work at home.

## 4 Findings

### 4.1 Invoices as a work artifact

An invoice is not just a piece of paper for our participants but an artifact to work with for various purposes. The invoices are necessary for making payments, organizing financial affairs, or associating contracts with a company. For instance, Amelia (27 y.o.) stated that invoices include anything she receives from another company when she purchases a service or product. Similarly, Ava associated invoices with the services she received: ‘Water and electricity, gas, newspaper, telephone. Those are the invoices’ (Ava, 55 y.o.).<sup>4</sup> For Noah, an invoice is ‘resulting from, for example, contracts you’ve entered into, so monthly accruing fixed costs, respectively, monthly debits generally from things you’ve bought’ (Noah, 28 y.o.).

Our participants also developed mundane and procedural knowledge to make use of invoices. In the following, we want to analyze this knowledge in more detail, outlining the material and meaningful structure of invoices from the domestic perspective of our participants.

**Structure and Materiality** Invoices can look very different but follow specific conventions that make them recognizable to our participants. These conventions result from legal requirements but also express the common knowledge of what an invoice looks like. As shown in Fig. 1a, an invoice in Germany usually contains (1) the name and address of the company, (2) the name and address of the invoice recipient, (3) an invoice number, (4) the date of invoice, (5) the date of delivery or service, (6) information on the type and number of goods delivered

---

<sup>4</sup> The interviews were conducted in German language, and the quotes have been translated by the authors for this paper.

**(a) Paper-based receipt:** A receipt from 'elektro%utlet' for a 'RECHNUNG' (invoice). It includes details like 'METHODE', 'NETTOBETRAG', and 'NETTOBESTAND'. A signature is visible at the bottom.

**(b) Email receipt:** A receipt titled 'THANKS FOR CHOOSING TIER' with the message 'DEINE FAHRT MIT TIER SEHR SCHÖN! DU HAST EINE FAHRT MIT TIER BEENDET.' The total amount is 'GESAMT 2,64 €'.

**(c) Web portal screenshot:** A screenshot of a website titled 'Meine Bestellungen' showing order details for 'Apple TV 4K' and 'Apple TV 3. Generation'.

**(d) American Express Blue Card Monthly Statement:** A statement titled 'American Express Blue Card Monatsabrechnung' for the month of 'März 1 1982'. It lists various transactions and a total balance of '144,20 €'.

**(e) Paper-based receipt:** A receipt from 'E1 Torpedos' with a total amount of '2,64 €'. It includes a barcode and a QR code.

Figure 1. Examples of German invoices: (a) Paper-based, (b) Email, (c) Web portal, (d) Bank statement served as an Invoice, (e) Receipt.

## Making Order in Household Accounting - Digital Invoices as...

or type and duration of service. It is also common for invoices to include (7) tax numbers, VAT rates on item level (8), as well as a total (9). The tax-relevant information indicates that legal transactions are not only conducted between two parties (company and client) but are also structured by the tax system (state), where invoices present a boundary object within the cooperative work between the tax office and citizens or companies. In some cases, invoices also contain explicit status information (open invoice, the invoice has been paid) as well as explicit instructions for action, such as (10) 'Payable after receipt of the invoice'.

Traditionally, invoices in Germany were paper-based (such as in Fig. 1a). However, digital invoices are also common today and are becoming increasingly prevalent. All participants stated that they receive invoices in both paper and digital form. Although most invoices are received digitally via email (such as in Fig. 1b), our respondents saw paper-based invoicing by mail as the most common variant. Benjamin referred to paper-based invoices as the 'classic' ones and only considered such objects as invoices 'that come to me by mail' (Benjamin, 61 y.o.). Another type of digital invoice is one from service providers (e.g., health insurance, mobile operators) or e-commerce retailers (e.g., Amazon) and made available through a web portal (such as Fig. 1c) or app. In the case of ongoing contracts with direct debit, some participants also consider account statements (such as Fig. 1d) as a type of invoice. From a legal perspective, such account statements do not represent an invoice, but they are perceived as invoices by some participants as they have a similar function.

The particular structure of the artifact affords certain forms of work. For example, our participants mentioned they do various things with paper-based invoices, such as stapling, putting them somewhere, tucking them away, or writing something on them. Kim, for instance, mentioned: 'My mother always writes the date and "done" on what she has paid for by hand' (Kim, 24 y.o.). The small size and weight of cash receipts from supermarkets and shops allowed them to be carried in the pocket, stapled together, cut up, torn, etc.

Digital invoices have different affordances, depending on their format and the tools used to work with them. Email-based invoices, for example, can be easily forwarded, replied to, sorted into mailboxes, and searched, and one can easily cut and paste information from them (like the IBAN) elsewhere. For other processing purposes, however, they must be saved or printed out first. Invoices sent by email also reach consumers in various formats, such as plain-text, rich-text, HTML, and/or as an attached file, commonly in the exchange format 'PDF' (Portable Document Format). Thus, the email itself or the contained file is archived. Invoices provided by web portals or apps offer a good overview but are limited to one company or marketplace (-operator). In addition, if they are edited and used or processed elsewhere, they must be transferred to other formats, saved, exchanged between devices, or printed out first.

**Goals and Meanings** Fundamentally, invoices contain essential information about a business transaction. This information is summarized in a very compact and schematic manner using various abbreviations and technical expressions (such as VAT, VAT ID, IBAN, customer, or invoice number). This schematic structure indicates that the meaning of the information will be understood by established knowledge practices and common knowledge stocks. The specific structure of invoices and their meaning are not taught in school. Instead, our participants learned to read and manage invoices informally through experience with accounting work.

By their very nature, invoices are intended to be paid. For companies, this is one of the main reasons for invoicing. From a consumer perspective, paying the invoice is also a common goal when they receive them. However, invoices also serve as working artifacts for a variety of other activities, such as filing a tax return, canceling a contract, reselling a product, substantiating a warranty claim, complaining about or resolving an issue with customer support, or splitting costs. All these activities shape the meaning that invoices have for the participants.

Over the years, our participants have gained some level of ‘invoice literacy’. The general knowledge the participants acquired includes taking it for granted that invoices must be paid (and what needs to be done if they are forgotten), knowing which invoices must be kept, which invoices need to be submitted to the tax office, which invoices are essential in the case of a warranty claim, and how to use invoices to keep household accounts. ‘It depends on how important it seems to me. So, I prioritize and then see if I keep the invoice at all’ (Kim, 24 y.o.). Whether and how they might need invoices later influences the participant’s decision of whether an invoice is significant or not. As said by Henry (81 y.o.): ‘I understand Invoices as a request for payment that a company gives me’.

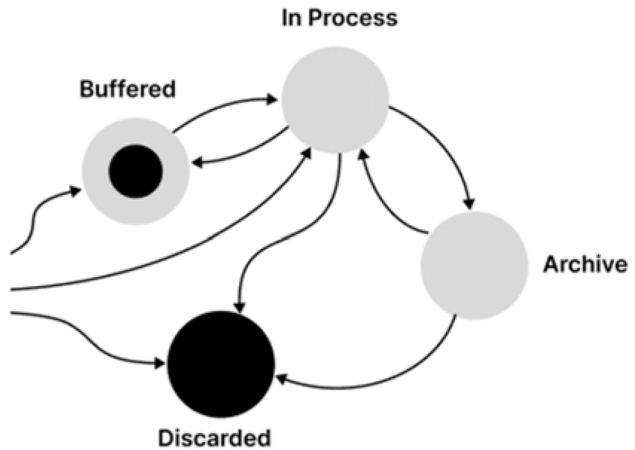
The meaning of an invoice for a person has implications for the definition of what is considered as an invoice. For instance, a cash receipt is considered as an invoice from a legal perspective, but among our respondents, it is controversial whether cash receipts are a type of invoice. Many respondents did not initially consider cash receipts part of their relevant set of invoices but ultimately included them after further reflection in the interviews. As noted by Noah: ‘Basically, you could now also include cash register receipts [...] Whereby I don’t keep them [...] but in the form, yes, actually also an invoice’ (Noah, 28 y.o.).

Beyond the common knowledge of handling them, invoices also have a personal and emotional meaning for the participants. For some, working with invoices represents a rather annoying necessity in their private life. Noah, for instance, stated: ‘[...] invoices [are] actually never really something nice. So, they’re always stressful – or what do you mean by stressful – It’s just annoying. Let’s put it that way. Annoying and just something that must be done’. Others associate invoices with intense feelings of shame, bad conscience, and fear. Henry (81, y.o.), for instance, fears having forgotten something: ‘If the suspicion is raised or I would be asked that I have not paid the invoice, that it is ascertainable by me if I then pick that up’.



## Making Order in Household Accounting - Digital Invoices as...

**Figure 2.** Simplified state transition diagram characterizing the invoicing process.



### 4.2 Invoicing as a stateful process

The term ‘invoicing’ indicates that an invoice is not just a dead artifact, but a living document. Traditionally, invoicing has been studied from the company perspective, which defines invoicing as creating and sending out invoices, requesting payments for work completed, a service provided, or a product delivered (Cambridge Dictionary)<sup>5</sup>. We use the term invoicing regarding the consumer side, referring to the messy activities where our participants pick up and use invoices (such as paying, making a tax declaration, etc.).

The specific performance of such activities was almost unique to every situation. Yet, in a very simplified manner, we can identify recurring states for multiple invoicing activities. In the simplest case of a payment process, an invoice could have the states: ‘*TODO*’ or ‘*DONE*’.

Figure 2 presents a simplified state transition diagram of the observed invoice management. Despite all the differences in detail, the model results from a recurring pattern in the organization of work that we have seen in the data.

**Buffered** Buffered denotes the state where a received invoice is preliminarily stored for taking care of it later. Buffering depends on the type of invoice and the context of receiving it. For instance, cash receipts from shopping consumables are often thrown away directly without buffering.<sup>6</sup> However, some consumers use their pockets or wallets as a buffer, where they routinely put paper slips in to sort and deal with them later. Invoices sent by email or mail are often buffered at designated places such as the email inbox, a basket, or just put on a stack of

<sup>5</sup> <https://dictionary.cambridge.org/dictionary/english/invoicing>

<sup>6</sup> Note that in Germany, where our study takes place, there is no general law requiring cash receipts to be kept (unless for specific tax or warranty purposes), unlike in some other European countries.

unopened (or opened yet still unprocessed) mail. Instead of dealing with them immediately, these invoices are waiting to be picked up later.

One of the reasons for buffering is that our participants only have limited control over when and how they receive invoices. From the consumer's point of view, getting an invoice represents an external event that might come when they do not have the time or inclination to deal with the issue right away. We typically observe various buffering practices for dealing with the temporal contingencies of receiving invoices. Our participants also mentioned several reasons for this kind of buffering. Sometimes, people receive invoices for already paid product services, which require no further action but simply provide documentation. In addition, companies often allow several days and weeks to pay an invoice, so an immediate reaction is unnecessary.

**In Process** 'In process' denotes the state where our participants engage with the invoice actively. There are various reasons and occasions for our participants to process an invoice. First, they must decide whether the invoice needs to be paid, whether it should be archived, or whether it can be thrown away. For instance, our participants receive 'to-be-paid' or 'already paid' invoices. These to-be-paid invoices are taken in hand for payment. By doing so, they change their status to a paid invoice, which could be discarded or archived (depending on several circumstances described in the following section). In our observations, already paid invoices mainly resulted from upfront payment methods in case of shopping or continuing obligations (such as mobile phone contracts). Payment methods vary between direct payment (like point-of-sale cash payments or electronic payments) or purchase on account.

In addition to paying invoices, there were various occasions when our participants searched through their archives to pick up invoices. For example, they may do this when doing their tax return, canceling a service, keeping track of expenses, checking purchases or deliveries, and claiming a guarantee.

**Archived** Our participants did not always discard invoices after processing them; they frequently archived them instead. They archived them for explicit reasons, such as the need to have these documents for tax returns or to prove the purchase to the seller or authorities. However, it seems that sometimes invoices are archived because it has become a routine or habit, as noted by Benjamin (61 y.o.): '[T]here is simply a principle: I keep all invoices'. This habit appears to be driven by a desire to maintain a general paper trail in case an invoice is needed later, even when it seems unlikely, or by the fear that it might be crucial in the future. By archiving everything, consumers may reduce the burden of making keep-or-discard decisions regularly.

Invoices are often archived directly after processing. Sometimes, it is done immediately after checking them, such as in the case of paid invoices, as mentioned by Charlotte (57, y.o.), 'The invoice from the insurance company is just for information because the insurance company has a direct debit policy'.

## Making Order in Household Accounting - Digital Invoices as...

Concerning post-processing, we also saw that some participants placed them in a particular place (cf. post-processing buffer) rather than directly archiving them, indicating that they would archive the invoices later.

**Discarded** Most invoices are not kept forever but are thrown away or destroyed at some point. Generally, our participants threw invoices away when they realized that keeping them was no longer relevant and that deleting them would be beneficial. It can happen at any time and sometimes occurs immediately after a participant receives a cash receipt or after paying an invoice. Discarding invoices often occurs when participants clean up their archives to create space and organized their records. Discarding was not always a conscious process, however. Sometimes invoices are simply lost over time. This is usually noticed when someone needs an invoice for some reason but can no longer find it. The most common benefit of deleting documents from the archive was to save space in the analog context. Digital invoices were typically kept because of the increased storage capacity (and the low memory impact of a few kilobytes per invoice), so active deletion was often not necessary.

We used the simplified model shown in Fig. 2 as an analytical lens to study the flow of invoicing work. Depending on the type of invoice, the invoicing process can be more complex than in this simplified model. For example, some participants had a strategy of not paying an invoice immediately, but only after receiving the first (free) reminder. In this case, invoicing can have additional states such as: 'Invoice received', 'First reminder received', 'Invoice paid', and 'Invoice archived'. In Germany, dealing with medical invoices for privately insured individuals is even more complex, as consumers may pay the medical invoice directly but then receive reimbursed from the health insurance company and employer. In this case, the flow of the invoicing work can include states such as: 'Invoice received', 'Invoice paid', 'Invoice submitted to the health insurance company', 'Invoice submitted to the employer', 'Invoice reimbursed by the health insurance company', 'Invoice reimbursed by the employer', etc.

The participants sometimes mark the current state of an invoice-related task on the invoice itself. For example, they might write 'Paid' on a paid invoice or mark it with a symbol and the date after they have processed it. As we describe below, our participants often use self-created ordering systems to track the process and make the state observable, such as by placing invoices in a specific location that signifies that they must still be checked or archived. For example, Noah notes, 'I have the [invoice] lying on the table in the kitchen and have put a post-it in the hallway with the heading "Pay invoice medical supply store"' (Noah, 28 y.o.).

Archiving and sorting into folders indicate that the invoice has been checked and paid. Sometimes, the actual status is unclear and cannot be discerned from the invoice itself or the ordering systems. This applies especially to chaotic ordering systems. Such a situation would lead to uncertainties and more significant effort to determine, for example, whether an invoice still needs to be paid.

### 4.3 Filling systems used for invoicing

An essential part of invoicing is to get an overview of which invoices need to be processed and to find the necessary information and documents for other tasks, such as filing a tax return or obtaining reimbursements from insurance companies. We observed that people developed their ordering systems for these purposes. These systems consist of specific locations, tools, practices, and conventions for organizing invoices according to various principles. In the following, we will discuss these ordering systems in more detail.

#### 4.3.1 *Buffer*

Buffers are intermediate storage areas that keep invoices temporarily while waiting for the next processing step. Our respondents used them to pause their work process and continue it later.

Buffers are used before or after specific activities in the editing process. They remind humans of tasks that they need to do later. We could distinguish various types of buffers based on their purpose.

**Input buffer** When an invoice is received, the participant's billing work officially begins. In addition to getting cash receipts (e.g., parking receipts, restaurant receipts, retail receipts), our participants receive most invoices either physically in their mailboxes (see Fig. 3a), digitally in their email inboxes (see Fig. 3b), or through the web portal or app of the service provider (see Fig. 3c). These input buffers mark the transition between the public and private spheres and are used by consumers or household members.

Regarding this, invoices stored in the web portals/apps of the providers present a particular case. The design of these portals/apps restricts the user's ability to configure ordering systems for personal purposes. Even if the functions of the different ordering systems are not always clearly distinct, they can be simplified into buffering and archiving systems.

For instance, some web portals/apps support input-buffering practices, such as highlighting which invoices are new or unread. Additionally, bank statements can be used as a tool for invoicing work. In the case of automatic direct debiting of monthly service fees (e.g., for Netflix, Spotify, electricity, and communication), reviewing bank statements helps to get an overview of which services have been paid in each time frame (and to check if a specific service has been paid or not, for example when a participant receives a reminder that an invoice is overdue). Some participants noted that they sometimes search through corresponding invoices in apps, web portals, emails, or letters just in case something unusual happens.

Regarding paper-based invoices, there was also a common practice of placing letters in a visible location at home (see Fig. 4) but leaving the letter closed,

# Making Order in Household Accounting - Digital Invoices as...

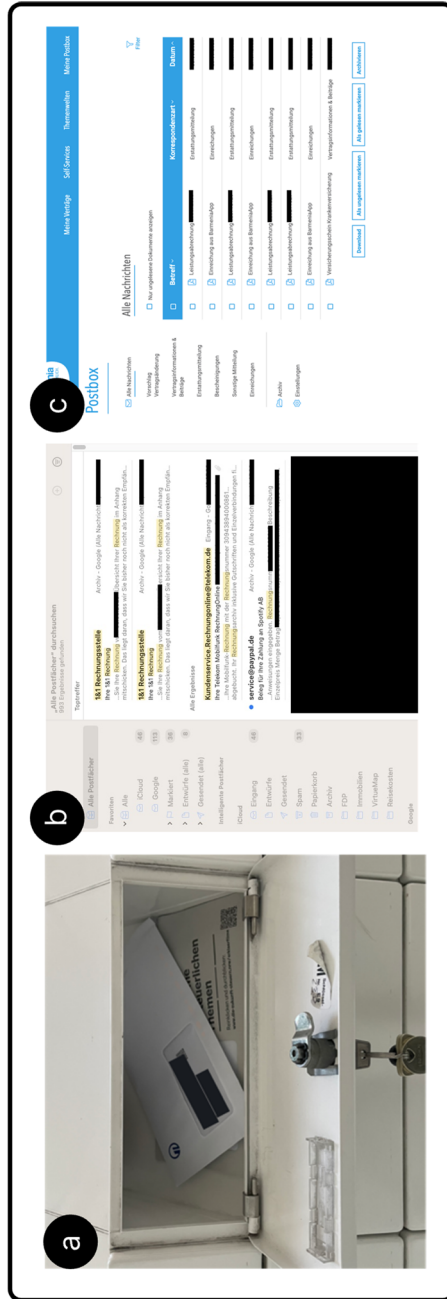


Figure 3. Input buffer: (a) letterbox with newly arrived letters, (b) inbox with unread emails, (c) unread messages in the web portal.

signaling that it has not yet been checked. Pragmatically, older invoices should be placed on top (following the First-In-First-Out principle) because they typically need to be paid sooner (e.g., within the next 14 days). However, these letter stacks are typically unsorted, with the newest letter on top for practical reasons and older ones at the bottom. This structure constitutes a last-in-first-out affordance. In principle, this upside-down order is dysfunctional because the lowermost mail is often the most urgent. However, in most cases, this does not cause any practical problems because the input buffer was usually not very large and was processed in bulk (some consumers had regular invoicing habits, while others acted when the stack looked big enough and things were beginning to feel too disorganized).

**Pre-processing buffer** Input buffers have the disadvantage of mixing invoices with other letters and emails. Therefore, each email/letter must be checked to determine whether it is an invoice and if and when it needs to be paid. In our study, we observed the typical habit that after this initial checking, invoices were stored in a pre-processing buffer until they were handled.

The checked-but-not-handled paper-based invoices were typically stored in a specific location in the living area, such as the kitchen table, a chest of drawers/cupboards, or on the desk (see Fig. 4). Like the input buffer, the invoices were typically stacked, constituting a Last-In-First-Out (LIFO) affordance. In some cases, this buffer consisted of more than one stack, for example, pre-sorting them by type, but most often to express priority. Depending on the importance and due date of the invoice, the participants made marks on the invoice itself and created notes or reminders elsewhere.

These stacks also served as a reminder for participants due to their location in the living area. According to Noah (28 y.o.), the participant is more likely to



*Figure 4.* Stacks of pre-sorted invoices.

## Making Order in Household Accounting - Digital Invoices as...

remember the processing deadline if the storage location was more unsettling: ‘So either in the hallway, on the dresser, or the kitchen table, so it’s as present and annoying as possible, and you always have to think about it’. We also observed that participants located the pre-processing buffers near the place (desk, kitchen table, etc.) where they worked on the invoice.

Regarding digital invoices received by email, we observed a similar practice mentioned by Whittaker and Sidner (1996) for organizing emails in general. For example, after reading the email, participants marked it as a new unread message to highlight that the invoice still needed to be processed or moved to a unique, self-created folder in the email inbox with a name, such as ‘house’, ‘car’, ‘bank’, ‘tax office’, ‘insurances’, or ‘invoices’. Most participants said they forgot about digital invoices if they were not marked as unread or printed out directly.

Almost all participants mentioned that they printed out invoices at least occasionally. They put these printouts in the paper-based pre-processing buffer and handled them in the same way as the other paper-based invoices. This printout habit indicates that paper-based ordering systems align more closely with people’s everyday lives and practical needs in organizing their invoicing work. In some cases, they scanned or digitized paper-based invoices with a smartphone for digital archives (see below).

The average time spent in the pre-processing buffer depended on the individual working style of participants. For example, some participants tended to complete tasks immediately, while others delayed them to proceed with the invoices in bulk (see below).

**Post-processing buffer** As mentioned, our participants retrieved invoices for various reasons, such as reviewing a contract, substantiating a purchase, or filing a tax return. They retrieve the invoices from the pre-processing buffer or the personal archive. After completing the work, they sometimes threw away or archived the invoices. However, we observed that people typically did not sort them into the archive or throw them away directly but instead put them into a post-processing buffer. Olivia described this habit as follows: ‘I don’t actually throw them in the trash immediately, but maybe I move them from this present place to this other place, which is a bit further back at the desk, where a few things are already piled up’ (Olivia, 34 y.o.).

This storage can be a stack next to the pre-processing buffer in the same location following the same ordering principle (LIFO-Stack) for paper-based invoices. However, we found no indications of any methods of sorting or marking importance or urgency used in this context. The post-processing buffer tended to be more inconspicuous, as it had little reminder function and served only as a backup in case of a mistake that needed later investigation.

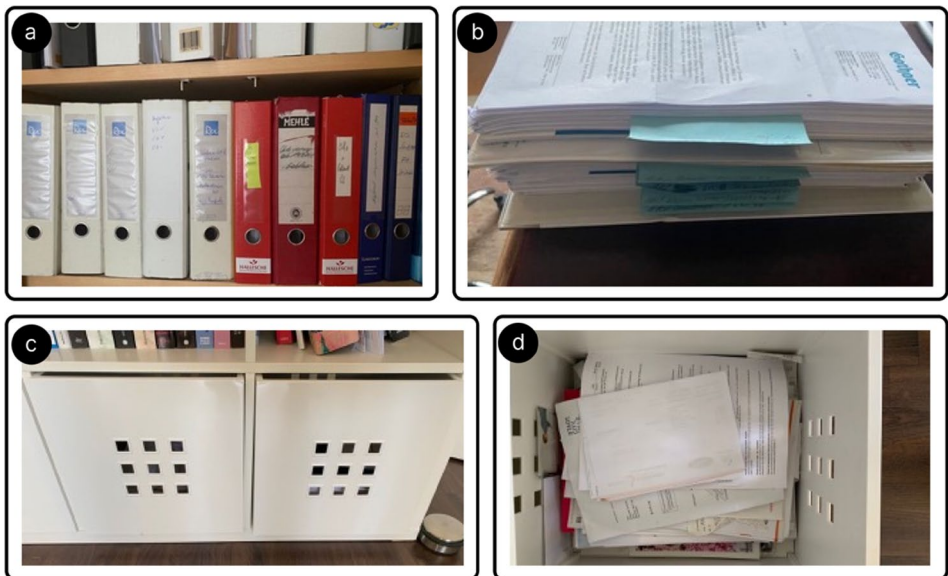
Many of our participants marked invoices as processed or paid. Invoices that had not yet been transformed into paper form were generally still processed in the email inbox and, as such, were either deleted, left unmarked, and unsorted in the email inbox, or archived immediately.

Due to the lack of externally imposed deadlines or dates that must be reached in the following processing, the respondent typically processed invoices within weeks or years without purposeful sorting.

#### 4.3.2 Archives

Many respondents had a personal archive system containing essential documents and records, such as birth certificates, training certificates, tax assessments, pension notices, ongoing contracts, and invoices (see Fig. 5). The form factor and organization of these archives varied greatly, and the amount of time the respondent stores the invoices depended on the type of invoice and the person's working style. The organization of the documents ranged from very chaotic systems (e.g., Fig. 5c-d) to very structured systems (e.g., Fig. 5a-b).

In the archive, invoices were stored for decades until they were discarded or used for one of the invoicing goals mentioned above (such as making a tax return). To facilitate re-use and related re-finding, our respondents organized and sorted invoices in various physical locations, with other media, and with varying levels of effort from respondent to respondent.



**Figure 5.** Locations of archives (a) open shelf with files, (b) thematic grouping, (c) closed shelf with boxes and organization of archives (d) chaotic order.



## Making Order in Household Accounting - Digital Invoices as...

**Paper-based archives** For paper invoices, the location of the archive was typically within a cabinet, shelf, or something similar. The cabinet then contained one or more thematically separated units. These units consisted of boxes, drawers, or file folders. We noticed that some participants divided a topic into one or more units to manage their archives. The most common solution chosen by interview partners was to use file folders to divide them thematically with dividers.

Regarding this, the German verb 'abheften' (filing something away) was often used to describe the characteristics of the ordering system and the activity of putting things in order. Most of our participants create a manageable set of subdivisions. 'And then I file them in the appropriate folder' (Charlotte, 57 y.o.). This kind of organization facilitates the retrieval of invoices and keeps all documents for specific transactions together. Within the smallest subdivision, the participants often filed the documents chronologically. The number of subdivisions and their organization depended on the volume of managed documents, as Emma explained: '[T]he more you have, the more you might want to have it sorted so that you can somehow find something again' (Emma, 24 y.o.).

The organization of personal archive systems was also influenced by how much time participants wanted to spend maintaining the system and retrieving documents. In this regard, individual practices were quite diverse. One extreme was represented by James (57 y.o.), who filed the archived documents 'very meticulously' in appropriate folders so that he could find them again when needed. The other extreme was presented by Oliver, who noted, 'Okay, so in the end, it's just a box, a box, where the stuff goes in'. Oliver's practice implements a fast-filing procedure but a slow retrieval strategy, which requires much effort when a specific document is needed later: 'Then I would try to look through all the channels where I have now ordered something together via my mailbox. That would involve a lot of effort' (Oliver, 26 y.o.).

Another aspect that affects filing practices is individual 'invoice literacy'. To decide whether and where to archive a document, our participants often needed to know which documents would be needed later and for what purpose. For example, Amelia (27 y.o.) noted, 'I have an extra tax folder' to make later tax return work easier. After the documents had been used for a particular purpose (e.g., making the annual tax return), some participants filed them in their standard archives like other invoices. Amelia's tax folder practice demonstrated that the organization of the archives expressed the current state of an invoice task, such as whether the tax return had been completed or not.

**Digital archives** Many digital invoices are printed out to store them in paper-based archives. All our participants, however, mentioned that they store various invoices digitally in parallel. As they received digital invoices via email, they used the email system as a digital archiving system. Due to large storage capacities, many participants, such as Noah, did not delete digital invoices, leaving

them in the inbox or moving them to dedicated folders: ‘I actually just leave it in the email inbox’ (Noah, 28 y.o.).

We also observed that some participants stored digital invoices on their local file systems in addition to other methods. For example, Amelia (27 y.o.) preferred a file system archive because she did not trust her email system as a long-term reliable repository:

‘I have a folder on my desktop, and I drag the invoices in there. [...] It’s organized in the same way as a physical folder. [...] But I don’t use cloud storage, everything is on the hard drive. I just use web.de [a German email provider] and it’s not very secure. If I think the server is down, I log off and still have all my invoices on my desktop.’

We observed that participants organized their digital archives following the principles of their paper-based counterparts. For example, some participants, such as James, created folders in their email and file systems to organize the documents by theme or invoice type: ‘I have a directory tree in the inbox with folders for invoices, home, invoices-other, and vacations. You can file them in the appropriate folder. It’s not as detailed as the [paper-based folder], but it’s still easy to find’ (James, 57 y.o.).

However, the digital archives provided new search affordances that some participants used. For instance, our participants said they use the built-in search function to find invoices in digital archives, making sorting increasingly obsolete. In the interview, Noah showed us how he uses the search function on his smartphone to find an invoice when needed: ‘I would just type “Telekom” in the search bar and then I would have my Telekom landline invoice for September quickly’ (Noah, 28 y.o.).

Online retailers and providers increasingly provide invoices only in web portals and apps. This practice restricts consumers’ options for organizing these documents, but they can still manually store them digitally or print them out if they want to file them in their archive system. We were surprised that none of our participants mentioned this as a restriction. In contrast, some participants said they trusted the providers to keep invoices available long-term and handle them confidentially. They only found it annoying and inconvenient that they had to manage credentials and log in to web portals to access the documents Fig. 6.

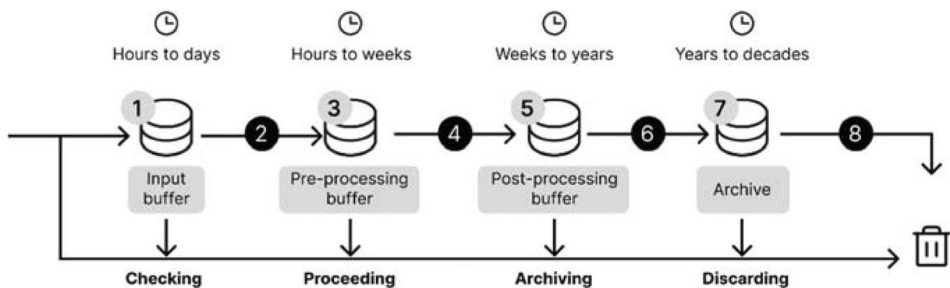
#### 4.4 Temporal patterns of invoicing work

The previous section outlined the lifecycle of invoices moving from input buffers to the archive. The specific conditions, the invoice subject, the materiality of the invoice, the individual working style, etc., affect how long each processing step takes and whether an action is delayed. However, we found some recurring temporal patterns in the life of an invoice concerning state model mentioned above.

## Making Order in Household Accounting - Digital Invoices as...

In the following, we provide an outline of the lifecycle of invoices and its temporal structure:

- (1) The lifecycle typically starts when participants receive an invoice via letter or email. However, it can take hours or days for people to notice the delivery (push principle). In addition, some invoices are stored in a web portal/app, where our participants access them only upon request (pull principle). Some providers use both methods, sending invoices via email and storing them in the web portal/app (push/pull principle). We also observed that participants check their bank account charges to determine if new invoices might exist that can be found in a web portal/app.
- (2) Upon receiving an invoice, all participants typically opened and checked it immediately. In many cases, the participants quickly determined if an urgent response was required or if it could wait to be processed later.
- (3) In many cases, after a quick check, our participants left invoices unprocessed but put them in pre-processing buffers. Delaying is a way of collecting tasks to work through them more efficiently. It also represents a form of procrastination. Very few of the respondents found invoicing to be a pleasurable activity. On the contrary, some participants tended to suppress or postpone invoicing work as much as possible. Our interviewees related that the duration between pre-checking and execution typically ranged from hours to weeks.
- (4) Because of the pre-processing buffering practice, we often observed that invoices in the buffer would be processed in bulk. Such bulk processing had some benefits for the participants, such as dealing with the (tedious) invoicing work less frequently (e.g., doing this job only on the weekends). In addition, bulk processing was typically also more efficient as most effort mainly consisted of work preparation (e.g., setting up the desk, searching documents, opening websites or apps to transfer money) and follow-up activities (e.g., cleaning up the desk, filing documents). Compared to this form of articulation work, the actual processing time was usually relatively short.



**Figure 6.** Typical temporal order of invoicing, including steps and storage.

- (5) Most participants did not archive directly after processing but put invoices in a post-processing buffer. This step had the benefit of decoupling the processing work from the archiving work. In many cases, an invoice that remained in these post-processing buffers stayed there for several weeks or even several years, as there was no external obligation to handle these post-processed invoices immediately.
- (6) When cleaning up the post-processing buffer, participants archived some of their invoices in a structured manner.
- (7) This structured filing involved searching for the right place in the personal archive system that followed its own logic. Some participants had a pure paper-based archive system, so they printed out electronic invoices to archive them. We have not observed the reverse case of a fully digitized archiving practice.
- (8) Participants rarely cleaned up their archives. Invoices remained in the archive for years. Furthermore, it seemed that they only deliberately threw away paper-based invoices. In principle, invoices contain confidential information, so the owner should shred or tear them up before disposal for security reasons. However, our participants rarely mentioned this issue. After a period of a few years (1-5 years) for most goods and up to several decades for long-term contracts, the invoice was removed from the archive. However, the period could be even longer, as James notes, 'because such contracts run for 20-30 years' (James, 57 y.o.).

#### 4.5 When it is time for invoicing work

External events and the work styles of participants also influenced the temporal patterns. In this regard, we observed three basic types when doing invoicing work: (a) direct completion, (b) handling at the next opportunity, and (c) postponing as far as possible.

**Direct completion** Some participants tried to process an invoice immediately after receiving it and either threw it away, archived it, or at least placed it in the post-processing buffer for archiving within the next hours or days. Noah, for example, said that 'it's a principle [...] for me to get invoices off the table as quickly as possible, no matter what form they come in' (Noah, 28 y.o.). Noah also files the invoice directly into his filing systems, with buffers rarely persisting for hours or days.

The entire invoicing process takes the shortest time for participants with these working styles, ranging from minutes to days. We also noticed that these participants did not limit their direct completion habits to invoices. They felt forced to perform their daily mandatory processes without delay.

## Making Order in Household Accounting - Digital Invoices as...

This style also affects the organization of the pre-processing buffer. For example, Noah put unpaid invoices in a prominent and disturbing place so that he did not forget to file them promptly: '[...] so that it's as present and annoying as possible' (Noah, 28 y.o.).

**At the next opportunity** Most participants collected invoices to work through them when time was available. Benjamin described this working style as follows: 'As soon as there is time available in the office, I process the invoices' (Benjamin, 61 y.o.). Kathy also described this next-opportunity style: 'I do it the next time I have time and feel like working on it' (Kathy, 38 y.o.).

This method somewhat decouples the processing of the invoice from its receipt, where the personal workload determines how much time should be spent on invoice-related tasks. Kathy's quote also suggested that it depends on one's mood. As Charlotte noted, the speed at which bills accumulate affects when the task is complete: 'I just collect a bit, and then [...] I only do it every 2-3 months if more comes [...] then I often file it away' (Charlotte, 57 y.o.).

As in the previous case, the next-opportunity style also affected the organization of the input buffers. Typically, participants chose a place for the input buffer so it was regularly visible as a reminder of the open task. This place was also often located close to the home workplace, enabling consumers to process the invoice bulk occasionally, such as during breaks from other activities. For example, Benjamin (61 y.o.) placed invoices that arrived on a small table next to the desk that holds his printer. If Benjamin took a break while working at his desk or had an opportunity to process an invoice, the stack reminded him, and he processed the invoice.

**Postpone as far as possible** Some participants postponed invoicing work as much as possible. On an emotional level, this working style seemed to be related to the human mechanism of repression and denial. Unlike in the previous case, piling up unfinished invoices does not trigger action but rather avoidance. As stressed by William, the perception of a large number of invoices leads to procrastination: 'So I noticed that I procrastinated, that so much has come at once sometimes I didn't feel like taking care of it at all' (William, 36 y.o.). However, postponing cannot be endless. For this reason, Charlotte (57, y.o.) used a trick to outsmart herself by writing reminders on envelopes or sending them to herself electronically via email. However, if she did not actively look at the envelope occasionally, she tended to forget or miss a payment deadline.

#### 4.6 Invoice management as a collaborative effort

Most participants lived in multi-occupant households where invoice management was typically a collaborative effort. In these households, we found that both individual contracts and joint contracts, such as electricity costs or the broadcasting fee, were shared by all household members.

In doing so, we often observed an informal division of labor in managing these individual and joint contracts where one person became responsible for invoicing and handling related concerns. While a general division of labor was common, the specific strategy to divide the work among each other was quite different.

**Division by topic** One strategy of participants was for one person to manage all contracts that belong together thematically. In Charlotte's case, for example, her husband took care of all invoices relating to the house and had his own filing system and archive for them: 'It's more my husband who gets them because everything concerns the house: gas, electricity, water, telephone. He gets all that and he gets that in his email box. And he has a filing system on his computer for that' (Charlotte, 57 y.o.).

**Division by competencies** Another strategy was for the person in the household perceived as most competent at invoicing to take on the responsibility. For example, Amelia (27 y.o.) took over the tasks of her partner due to his lack of country-specific and German language skills.

**Division by specialization** As shown above, invoicing work comprises various steps, such as reviewing, processing, and filing. In the case of Henry (81 y.o.), we observed a kind of specialization where he became responsible for one specific task, namely archiving. Henry and his partner had separate incomes and usually paid their invoices in partnership: 'In this respect, the invoices are paid for each one individually. But I do all the administrative work that goes into the invoices' (Henry, 81 y.o.). He became responsible for this dedicated task because of his 'accounting' habit of keeping order: 'I'm used to being systematic from my work, filing everything nicely, picking everything up is second nature to me' (Henry, 81 y.o.).

**Division by dispatching** Another way of organizing the division of labor was to check who was responsible for receiving an invoice and then dispatch it to that person. This practice was encouraged by commonly shared input buffers, such as mailboxes or storage areas. As in Oliver's case, these input buffers were managed collectively to distribute work across the household based on an initial check: 'Actually, when I get home, there's either a letter there or there's not. But I honestly don't actively look in the mailbox because someone empties the mailbox and then distributes the letters' (Oliver, 26 y.o.). As in the case of Kathy, they

## Making Order in Household Accounting - Digital Invoices as...

also used the shared buffers to signal that there was work that they had not yet been assigned to someone: 'In case of doubt, the [letters] always end up all in the front at the phone table in the entryway' (Kathy, 38 y.o.).

**Who-pays-what Principle** We observed that the division of labor was closely connected with the question of who paid for what in a household. In most multi-occupant households, the members jointly paid for everyday goods and services, with costs divided among them. In this context, they negotiated which share they accounted to the community and which share they accounted to the individual. A particular case of this was the relationship between children and parents, which was also manifested in payment practices, as shown in the case of Sophia: 'Is this about my private pleasure [...] then I pay for it myself. If it's something health-related or something like that, then, of course, my mother or my parents will pay for it' (Sophia, 21 y.o.).

Evelyn described a common practice for organizing such joint payments: 'One person takes over [the payment] at the checkout, and then you have the receipt, and then it's just settled among each other that you transfer it or give it back in cash' (Evelyn, 31 y.o.). This joint financial management also affects invoice management, as was evident with Henry: 'I first collect the invoices over a while and then make a clean settlement with my life partner. We each pay half of the invoice. When the sharing is complete, the invoices disappear into the trash' (Henry, 81 y.o.).

This division of labor usually occurred routinely without any need for articulation work. Articulation work occurs only when responsibilities are unclear, as in the case of Evelyn dealing with joint contracts: 'So if everyone pays the invoice themselves, then we don't talk about it. So only with joint invoices do we have to coordinate with each other' (Evelyn, 31 y.o.).

A greater need for negotiation and articulation of the division of work occurred when partners started a new household together and had to harmonize different invoicing practices. We observed this situation in the case of Olivia, who recently moved in with her new partner. She described the challenge of bringing different practices together: 'So, I feel like they differ because, of course, I think my system is better than his. But it's always difficult to change an already existing system entirely' (Olivia, 34 y.o.).

Additional articulation work also results by eliminating paper-based invoices, which served as a coordination mechanism in the distributed work. We became aware of this role in cases where only one person received the invoices digitally via email. This process disrupted well-established routines of shared responsibility and dispatched the work to the person in charge. To deal with the digitalization of invoices, some participants printed them out, so they could be used as established coordination artifacts, such as putting the printed-out invoice in the physically shared input buffer. In addition, we also saw the formation of new digital practices,

such as using shared email inboxes or forwarding invoice-related emails to the person in charge. For instance, Isabella (21 y.o.) reported that her family used her father's email inbox for all contractual matters. The digitization process significantly influenced the division of labor and the associated procedures.

## 5 Discussion

Household management presents a work practice mostly neglected by mainstream research. Self-critically, this also applies to large parts of CSCW research. Feminist research has drawn the most attention to it to expose the unequal distribution of work and campaign for better working conditions.

Numerous feminist studies in sociology show the unequal distribution of work in the household (Hochschild 1989; Mederer 1993; Winkler and Ireland 2009). The great merit of these studies is their ability to draw attention to a relevant social problem. In the context of feminist CSCW research, however, these studies gloss over the situated nature of the work practices but only measure the temporal and mental workload. Consequently, the feminist demand to reduce undesirable household work (E. Emens 2019; E. F. Emens 2015; Frederick 1921; Gilbreth 1927) remains more programmatic than empirically grounded. With its tradition in workplace studies (Schmidt 2000), we believe CSCW research can contribute to this gap in feminist research.

With our study, we make a first step in this direction by studying administrative household work as a socio-material practice. In this respect, we see our study contributing on three levels:

- **At the methodological level:** Our study demonstrates how to overcome the limitations of time-series studies to empirically research situated household work.
- **At the level of the subject matter:** Our study reveals how people accomplish mundane administrative household chores by making order and structuring the work.
- **At the design level:** Our study provides insights and requirements for the design of support systems beyond process automation.

The following sections discuss these three contributions of our study in more detail.

### 5.1 'Get a grip' on domestic work

It is a methodological challenge to 'get a grip' on domestic work because of its highly unstructured, implicit, and invisible nature, where tasks are often taken for



granted and performed concurrently with other activities (Daminger 2019; Daniels 1987; E. F. Emens 2015; Winkler and Ireland 2009).

While the socio-materiality of the kitchen as a domestic workplace has been studied in the early days of household research (Frederick 1921; Kuhn 1998; Meyer 2021), ‘getting a grip’ on the administrative work at home is still an open challenge. A prevalent method in the literature is time budget surveys (Anxo et al. 2011; Craig and Powell 2018; Krantz-Kent 2009; Moreno-Colom 2017; Möser 2010; Winkler and Ireland 2009). The merit of these surveys is to shed light on the immense quantitative time burden associated with domestic paperwork and its unequal distribution between genders. Yet, these studies have several limitations. Firstly, they provide only a vague estimation of the time spent due to the messy, fragmented nature of these activities (Winkler and Ireland 2009), and the numbers do not capture the subjective dimension of time use, the meaning given to activities, the perceived work quality, and the physiological and cognitive cost of household work (Habib et al. 2010; Moreno-Colom 2017). Most importantly, they fail to capture the practical execution of this kind of work, making its spatial-temporal ordering and accomplishment visible.

Another commonly used method in home economics is relying on abstract models on how household accounting should be done and how business accounting concepts could be simplified for private users (Gomes et al. 2021; Hoque 2006; Langhojer 2009; Piorkowsky 2000). However, there is a danger of glossing over the messiness of domestic work and neglecting the situated context, and practical demands. The failure stories and limited market success of household accounting tools show that it is not just an academic issue, and that ‘getting a grip’ on situated domestic work is of practical relevance.

We have shown how the methodological toolbox provided by CSCW can be adopted for this purpose. While previous studies on CSCW have mainly focused on money work (Dolata and Schwabe 2017; Kaye et al. 2014; Perry and Ferreira 2018; Pritchard et al. 2015), our main goal was to get a grip on the household accounting as messy, fragmented domestic work Table 2.

Moreover, Table 2 shows, where our *following-the-invoice* methodology contributed to previous research. This methodology allowed us to gain detailed and novel insights into the domestic ordering systems established and utilized by household members for this purpose.

## 5.2 Ordering systems used for household accounting

Our study confirms previous studies (Harper and Sellen 1995; Taylor and Swan 2005; Vines et al. 2014) that people use multiple ordering systems at home. Our study contributes to this research and explores these related practices in fine-grained detail. For instance, we found no related work that distinguishes between pre-processing and post-processing buffers.

**Table 2.** Topics to which the ‘following-the-artifact’ methodology contributes.

Topic	Contribution
Working times	Time budget surveys implicitly assume that tasks have a clear beginning and end (Hamermesh et al. 2005). Through <i>Following-the-invoice</i> , however, it becomes evident that the beginning and end are not natural given. It is a result from artful competency to create temporal order with the help of buffers, reminders, and sorting orders to manage the distinction between working time and processing time.
Work placement	Previous domestic studies (Harper and Shatwell 2002; Taylor and Swan 2005; Vyas et al. 2016) emphasize that work placement is a vital resource for coordinating domestic activities. With <i>Following-the-invoice</i> , we gain additional insights about the spatial-temporal nexus of this placement, which aligns with the workflow. For instance, the pre-processing mainly aims to make the work visible, while pre-processing placement aims to make the work invisible so that it does not disturb the home’s aesthetics as a place of leisure and relaxation.
Work Distribution	Feminist studies show that domestic paperwork is unequally distributed (Daminger 2019; E. F. Emens 2021). <i>Following-the-invoice</i> gives us additional insights about the domestic division of labor in practice regarding responsibilities, organizational issues, and reasons given.
Interface Work	Business accounting (Deshmukh 2006) and domestic work (Vyas et al. 2016), are commonly perceived as distinct research fields. <i>Following-the-invoice</i> , however, shows that digitalizing the invoicing process affects existing household accounting work in unintended ways. Individuals are required to perform interface work to make the external invoicing processes compatible with the internal ordering systems.

Table 3 provides an overview of the various artifacts that bring order to domestic invoice management. As our findings show, these artifacts serve as buffers to structure, organize, and articulate the invoice work process and archives that build up the financial memory of the household.

**Goals** Our study has shown that invoicing work, as a financial activity at home, has various goals. Adopting the taxonomy of Vyas et al. (2016), we can distinguish invoicing work that serves short-term goals, such as paying an invoice, from that which serves long-term goals, such as archiving an invoice for later use. These different goals reflect the corresponding ordering systems. For instance, we have uncovered that the size and physical locations of buffers typically address short-term goals, while the organization of archives typically addresses long-term goals.

**Retention time** Our study showed that buffers and archives have some typical retention times. The buffers were primarily used for short-term goals, and their retention times differ according to their functions. The input and pre-processing buffers have the shortest retention times, while invoices typically remain longer in post-processing buffers, which are the preliminary stage to final archiving. In archives, invoices will typically be stored for years to decades.

**Table 3.** Overview of ordering systems used in households to organize invoices and the invoicing work.

	<i>Buffer</i>		<i>Archive</i>
	<b>Physical</b>	<b>Digital</b>	<b>Physical</b>
<b>Goals</b>	Short term goals		Long term goals
<b>Retention time</b>	Input Buffer: hours to days Pre-processing Buffer: hours to weeks Post-processing Buffer: weeks to years		Years to Decades
<b>Location</b>	Kitchen Table, on the Cabinet, Dresser, Desk, etc.	Email Inbox, Service Provider/Retailer Apps	In the Cabinet, Shelf, etc. Email Inbox, App, Hard Drive
<b>Ordering principle</b>	Organically, often chronological	Chronologically	Chronologically, Thematic, Numbered/Alphabetical
<b>Search support</b>	No	Full-text search	No Full-text search
<b>Articulation &amp; Awareness</b>	High	Email: Medium Apps: Low	Medium-Low Low

Table 4. Overview of design issues.

Topic	Gained insights	Design issues
<b>Workflow support</b>		
<b>Tasks</b>	Dealing with invoices does not serve one purpose only, but is part of various activities (such as paying, doing taxes, and handling claims)	<ul style="list-style-type: none"> <li>• Design should not focus on a single task but should consider several purposes.</li> <li>• Design should focus on making common tasks efficient but also facilitate non-anticipated purposes.</li> </ul>
<b>Processes</b>	Invoices have a life cycle. They are used together with other records in multi-stage workflows.	<ul style="list-style-type: none"> <li>• Design should allow users to implement at least their simplified workflow, as shown in Fig. 2.</li> </ul>
<b>Channels &amp; Formats</b>	Digitization has led to a multiplication of the channels through which household members receive or retrieve invoices and other documents. The same applies to the data formats.	<ul style="list-style-type: none"> <li>• Design should recognize the co-existence of multiple human-readable data formats (paper-based, HTML/text, and pdf).</li> <li>• The industry should standardize machine-readable invoice formats, which can be included in human-readable formats (such as QR codes or as meta-tags in HTML/pdf).</li> </ul>
<b>Buffering</b>	Various forms of pre- and post-processing buffers organize administrative work in practice, deal with the fragmentation of the work process, and signal the current work status.	<ul style="list-style-type: none"> <li>• Design should support buffering, including means for pre- and post-processing buffering.</li> <li>• Design should provide features of both functions of buffers: <ul style="list-style-type: none"> <li>- Temporal, enabling different work rhythms and signaling work status.</li> <li>- Spatial, raising awareness and embodying the work in the social space of the household.</li> </ul> </li> </ul>
<b>Living documents</b>	Invoices are not immutable pieces of information but living documents edited by household members over time.	<ul style="list-style-type: none"> <li>• Design should provide means for labeling, marking, annotating, and putting records together.</li> <li>• Typical ways of labeling and marking should be efficient, but non-anticipated cases should also be possible.</li> </ul>
<b>Task Awareness</b>	Some tasks are tied to deadlines that are often overlooked due to a lack of awareness.	<ul style="list-style-type: none"> <li>• Design should support task and deadline awareness (such as paying a bill, canceling a contract, or making the tax on time) and warn the user actively if needed.</li> </ul>

Table 4. (continued)

Topic	Gained insights	Design issues
<b>Archiving support</b>		
<b>Archiving</b>	Archiving invoices is a common practice for maintaining the household's organizational memory.	<ul style="list-style-type: none"> <li>• Design should support the archiving, including means for filling, sorting, retrieving, and cleaning up.</li> </ul>
<b>Ordering</b>	Invoices and other records are stored by various ordering principles in practice.	<ul style="list-style-type: none"> <li>• Design should support a set of common ordering principles (such as chaotically, chronologically, thematically, alphabetically), but enable users also to store them based on their own ordering principles.</li> </ul>
<b>Retrieving</b>	There is a tension to avoid investing time in sorting but aim to retrieve records efficiently.	<ul style="list-style-type: none"> <li>• Design should be aware that people do not want to spend time in filling and sorting but still want to retrieve records in a reasonable time.</li> </ul>
<b>Cleaning up</b>	Retrieving records is typically caused by a special task (like tax submission). Invoices do not have a fixed expiration date, but there is tension to keep records permanently and secure while having a clean and proper archive.	<ul style="list-style-type: none"> <li>• Design should support task-related retrieving of single documents but also document collections that are needed for the task at hand.</li> <li>• Design should provide means to ensure the long-term availability of the household's archives.</li> <li>• Design should provide means to clean up archives, but people fear of throwing away crucial documents accidentally.</li> </ul>
<b>Additional demands</b>		
<b>Cooperation</b>	Dealing with an invoice is a matter of cooperation and division of work.	<ul style="list-style-type: none"> <li>• Design should provide means for cooperation, shared document spaces, and informal division of work (such as division by topic, by specialization, by dispatching)</li> </ul>
<b>Hybrid-icity</b>	Dealing with invoices refers to hybrid practices, where analog and digital channels, records, tools, and archives co-exist in parallel.	<ul style="list-style-type: none"> <li>• Design should acknowledge the fragmented nature of invoices, which can exist in both analog and digital formats, and may also have redundant copies (such as when invoices are printed out or scanned).</li> <li>• Design should facilitate the transition, referencing, and linking between digital and analog artifacts throughout the entire lifecycle of invoices, encompassing their acquisition, buffering, processing, and archiving stages.</li> </ul>

**Location** For locations, we were able to ascertain that the physical locations differ significantly between buffers and archives. Buffers often have a prominent location, such as the kitchen table or dresser, so they are constantly visible to household members. In contrast, filed papers in the archive were hidden on a shelf or in a cabinet. Digital invoices, however, tend to remain in the same place throughout the entire invoice lifecycle, either in email inboxes or an app provided by a vendor/retailer. Some people also used cloud or hard drive folders as long-term storage, where they archived digital invoices in rare cases.

**Ordering principle and search support** Our study uncovered various ordering principles, especially in the case of archives, such as sorting them thematically, numerically, or alphabetically. The ordering principle also articulated who will be responsible (e.g., one person taking care of the insurance folder) and when invoices are needed (e.g., filing them in a tax return folder). Most commonly, buffers, but also archives, were organized in chronological order. The practice of putting new invoices on the top of a buffer created a kind of LIFO stack ('Last In First Out'), which risks overlooking older but urgent invoices.

The maintenance of ordering principles may create extra work initially, but it reduces the effort required for retrieval later. Concerning search support, digital buffers and archives supported retrieval through full-text search or the option to list documents, emails, etc., by different criteria such as time, sender, or subject. Creating order in the filing system became obsolete within full-text search.

**Articulation/ Awareness support** We observed that the location and ordering of physical buffers supported awareness of which invoice work needed to be done. In addition, shared spaces, such as the kitchen table, helped people coordinate and articulate the work among household members. While the perception of physical buffers was very strong, the perception of digital buffers was low. This was especially true for invoices provided in apps or web portals when one did not receive an additional email or notification about them.

Due to the lack of open tasks, the perception of the physical and digital archives was quite low. Invoice emails could get lost among the many other emails stored in a client's inbox, and physical folders, boxes, shelves, or cabinets used as archives were often hidden to avoid disrupting the domestic aesthetic.

### 5.3 Implications for design

There is a current trend towards eliminating of paper-based invoices (Gupta 2020). Our study shows that electronic invoices provided by apps and web portals can help to organize invoices and make tasks, such as paying bills, more efficient. Yet, our study confirms that the 20-years-old insight of CSCW, that a

naive digitization of processes is harmful, when the importance of paperwork is neglected (Sellen and Harper 2003). Furthermore, the limited adoption of dedicated household accounting and invoice management tools could be due to a misguided design approach relying on abstract, rationalistic work models (2000; Walker 2008), while overlooking the inherent contingency, messiness, situatedness, and spatial-temporal orderliness of domestic administrative work.

Ethnographically informed workplace studies should not be reduced to simplistic ‘implications for design’ (Dourish 2006), but they can sensitize designers to contextual needs and providing accounts for the way people accomplish order (Schmidt 2000). With this in mind, we have listed in the insights gained from our study and the design guidelines derived from them.

Table 4 shows why general-purpose groupware, such as shared file systems, messengers, and email systems, are preferred in practice over specialized solutions. Specialized solutions are mainly designed as single-user applications, whereas general-purpose groupware better addresses the cooperative nature of domestic work. In addition, specialized solutions tend to be designed for the ‘rational user’ enforcing rigid process models, whereas groupware is more flexible regarding work styles, usage goals, and self-designed ordering systems (Balogh et al. 2022; Bellotti et al. 2002; Whittaker and Sidner 1996). Furthermore, as invoices increasingly arrive via email, email-based invoice management reduces the burden of import activities, pre-processing and post-processing them.

Table 4, however, also points to existing shortcomings of specialized systems and general-purpose groupware. None of these solutions address the hybrid character of invoice management very well. This lack includes the transition from paper-based to electronic documents and vice versa. Moreover, appropriate solutions are needed to support people to deal with the co-existence and messiness of hybrid ordering systems, where the spatiality of placement tasks and documents is critical.

Last, but not least, instead of enforcing one single task model, the design must be open and should provide means for manifold tasks, such as paying a bill or retrieving documents for tax purposes. Instead of using a prescribed process model as a design guideline, we should adopt the support lens of CSCW, providing resources that help users organize their personal records and accomplish the task at hand.

## 6 Limitations

Our primary aim was to make marginalized practices visible, yet future research should investigate in more detail, how these practices will be accomplished by marginalized people. In this respect, our study has several limitations. The study is based on the principles of qualitative research and has a limited sample size, which does not allow for quantitatively supported generalizations. While we

reached theoretical saturation about the main categories identified through the seventeen interviews, it should be noted that we only interviewed people from Central-Western Germany. As sociological and cultural factors can influence invoice management practices, the practices we observed may differ in other cultures, countries, and regions. Additionally, it is possible that the results were influenced by the homogeneity of the sample, which was selected using the snowball method and may have been composed of people with good education, parental guidance, and income. It is possible that other groups, such as those with lower levels of education, do not use any invoice management practices or utilize different practices.

## 7 Conclusion

There is a growing trend towards electronic invoices. This digitization promises to be eco-friendly and improve process efficiency. However, we must not reduce invoices to their informational content; they are also socially embedded artifacts that are integrated into established household routines, where people organize, coordinate, and articulate their invoice work. In addition, for many people, archived invoices serve as a financial memory for their household.

However, uncovering the artful work of dealing with invoices in research and design also supported our aim to bring to the fore this mundane work that is usually taken for granted. It became clear that household accounting has no price, but a value. Furthermore, although managing invoices is not a formally recognized profession, it is by no means unskilled work. It involves responsibilities, competencies, specialization, and delegation, and requires collaboration.

Following the actors along their paper trails, we reconstructed in minute detail the domestic life of invoices and the ordering system to manage them. Although the practices of our respondents were unique, our study showed that there were recurrent patterns in terms of temporal processing, applied ordering principles, and physical locations. These places were carefully designed to bring attention to the work of managing invoices, but also to hide it when necessary. This interplay of making visible and masking focuses on the unique nature of the domestic context as a place of work and leisure at the same time.

This study demonstrates how to apply a CSCW lens to the domestic context to inform and sensitize designers of consumer software to the importance of supporting established routines. The next step would be to conduct design case studies (Shankar et al. 2020; Wulf et al. 2011) implementing support systems for household accounting and examining their appropriation by consumers.



## Acknowledgements

We thank our participants for their time and insights into their daily lives and personal documents. We are grateful for the coaching provided by supporters, which improved the paper. A special gratitude goes to Beatrice Ernst, who was a major support in interviewing our respondents.

**Authors' contributions** Erik Dethier and Dean-Robin Kern collected and analyzed the empirical data and wrote the main manuscript text. Gunnar Stevens and Alexander Boden provided the main structure as well as the conceptual framing for the study and contributed to respective sections in the text.

**Funding** Open Access funding enabled and organized by Projekt DEAL.

**Data availability** The pseudonymized data can be requested by contacting the corresponding author.

## Declarations

**Competing interests** The authors declare no competing interests.

**Conflict of interest statement** The authors declared that they have no conflict of interest.

**Ethical Statement** According to the assessment of the Ethics Council of the University of Siegen, the study is considered ethically unobjectionable. The participants gave their consent to the pseudonymized analysis and publication of the data.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

Al-Omar, Masha'el, and Andrew Cox. 2013. Finders, keepers, losers, seekers: a study of academics' research-related personal information collections. In: *Human Interface and the Management of Information*.

- Information and Interaction Design: 15th International Conference, HCI International 2013, Las Vegas, NV, USA, July 21–26, 2013, Proceedings, Part I 15*, 169–176. Springer.
- Alvarez, Marina. 2017. VRM a technology of domination of self-The effects of vendor relationship management systems as tools for consumer empowerment. *The Information Systems Student Journal* 25: 2017.
- Anderson, Robert, and Wes Sharrock. 1992. Can organisations afford knowledge? *Computer Supported Cooperative Work (CSCW)* 1 (3): 143–161.
- Antonides, Gerrit. 2015. The division of household tasks and household financial management. *Zeitschrift für Psychologie*, 2015.
- Anxo, Dominique, Letizia Mencarini, Ariane Pailhé, Anne Solaz, Maria Letizia Tanturri, and Lennart Flood. 2011. Gender differences in time use over the life course in France, Italy, Sweden, and the US. *Feminist Economics* 17 (3): 159–195.
- Balogh, Matt, William Billingsley, David Paul, and Mary Anne Kennan. 2022. Understanding the management of personal records at home: a virtual guided tour. *Information Research: an International Electronic Journal* 27 (2): 926.
- Baxter, Janeen, Tsui-o Tai. 2016. Inequalities in Unpaid Work: A Cross-National Comparison. In, eds. M. L. Connerley and J. Wu. *Handbook on Well-Being of Working Women*. Dordrecht: Springer Netherlands.
- Bellotti, Victoria, Nicolas Ducheneaut, Mark Howard, and Ian Smith. 2002. Taskmaster: Recasting email as task management.
- Berndtsson, Johan, and Maria Normark. 1999. The coordinative functions of flight strips: air traffic control work revisited. In *Proceedings of the international ACM SIGGROUP conference on Supporting group work*. Presented at the GROUP99: Conference on Supporting Group Work, Phoenix Arizona USA: ACM: 101–110.
- Birch, Elisa Rose, Anh T. Le, and Paul W. Miller. 2009. Time Use Surveys. In, eds. E. R. Birch, A. T. Le, and P. W. Miller, *Household Divisions of Labour: Teamwork, Gender and Time*. London: Palgrave Macmillan UK.
- Bittman, Michael, and Judy Wajcman. 2000 The Rush Hour The Character of Leisure Time and Gender Equity. *Social Forces*, 79, 1(2000): 165
- BLS. 2022. *American Time Use Survey User's Guide: Understanding ATUS 2003 to 2021*. <https://www.bls.gov/tus/atususersguide.pdf>
- Braun, Virginia, and Victoria Clarke. 2012. *Thematic analysis*. American Psychological Association.
- Briscoe, Michael D. The paperless office twenty years later: Still a myth? *Sustainability: Science, Practice and Policy*, 18(1): 837–845.
- Brown, John Seely, and Paul Duguid. 2017. *The social life of information*. Harvard Business Review Press.
- Bryant, Antony, and Kathy Charmaz. 2010. Grounded theory in historical perspective: An epistemological account. *Handbook of Grounded Theory* 2010: 31–57.
- Cécora, James. 1991. *The role of "informal" activity in household economic behaviour*. Berlin: Duncker & Humblot.
- Ciciolla, Lucia, and Suniya S. Luthar. 2019. Invisible Household Labor and Ramifications for Adjustment: Mothers as Captains of Households. *Sex Roles* 81 (7–8): 467–486.
- Clarke, Edward A., and Michael Wilson. 2018. *Accounting: An Introduction to Principles and Practice 9ed*. Cengage AU.
- Collins, Daryl, ed. 2009. *Portfolios of the poor: how the world's poor live on \$2 a day*. Princeton, NJ: Princeton Univ. Press.
- Crabtree, Andy, David M. Nichols, Jon O'Brien, Mark Rouncefield, and Michael B. Twidale. 2000. Ethnomethodologically informed ethnography and information system design. *Journal of the American Society for Information Science*, 51(7): 666–682.
- Craig, Lyn, and Abigail Powell. 2018. Shares of Housework Between Mothers, Fathers and Young People: Routine and Non-routine Housework, Doing Housework for Oneself and Others. *Social Indicators Research* 136 (1): 269–281.
- Daminger, Allison. 2019. The Cognitive Dimension of Household Labor. *American Sociological Review* 84 (4): 609–633.
- Daniels, Arlene Kaplan. 1987. Invisible Work. *Social Problems* 34 (5): 403–415.
- Dean, Liz, Brendan Churchill, and Leah Ruppanner. 2022. The mental load: building a deeper theoretical understanding of how cognitive and emotional labor overload women and mothers. *Community, Work & Family* 25 (1): 13–29.
- Deshmukh, Ashutosh. 2006. *Digital accounting: the effects of the Internet and ERP on accounting*. Hershey, PA: IRM Press.
- DeVault, Marjorie L. 1987. Doing housework: Feeding and family life. In *Presented at the Families and work*, eds. N. Gerstel and H. E. Gross, 178–191. Philadelphia: Temple University Press.

## Making Order in Household Accounting - Digital Invoices as...

- DeVault, Marjorie L. 1991. *Feeding the family: The social organization of caring as gendered work*. Chicago: The University of Chicago Press. [https://www.jstor.org/stable/pdf/10.1525/si.1992.15.4.529.pdf?refreqid=excelsior%3Ac943faee0127438c6c709be6951dbbdb&ab\\_segments=&origin=&acceptTC=1](https://www.jstor.org/stable/pdf/10.1525/si.1992.15.4.529.pdf?refreqid=excelsior%3Ac943faee0127438c6c709be6951dbbdb&ab_segments=&origin=&acceptTC=1)
- Dolata, Mateusz, and Gerhard Schwabe. 2017. Paper Practices in Institutional Talk: How Financial Advisors Impress their Clients. *Computer Supported Cooperative Work (CSCW)* 26 (4–6): 769–805.
- Doling, John, and Rowan Arundel. 2022. The Home as Workplace: A Challenge for Housing Research. *Housing, Theory and Society* 39 (1): 1–20.
- Dourish, Paul. 2006. Implications for design. In: *Proceedings of the SIGCHI conference on Human Factors in computing systems*. 541–550.
- Duque, Garcia, and Carlos Alberto. 2021. Unpaid housework and super-exploitation of labor: A suggested model and empirical evidence from Mexico and Colombia. *Review of Social Economy*, 1–25.
- Emens, Elizabeth F. 2015. Admin, vol. *The Georgetown Law Journal* 103 (2015): 1409.
- Emens, Elizabeth F. 2021. Disability Admin: The Invisible Costs of Being Disabled, vol. *MINNESOTA LAW REVIEW*, 105 (2021): 2329.
- Emens, Elizabeth. 2019. *Life Admin: How I learned to do less, do better, and live more*. Houghton Mifflin.
- Frederick, Christine. 1921. *Household engineering: scientific management in the home*. Chicago: American School of Home Economics.
- Friedan, Betty. 1963. *The Feminine Mystique*. W. W: Norton.
- Gerrans, Paul Dirk, G. Baur, and Shane Lavagna-Slater. 2022. Fintech and responsibility: Buy-now-pay-later arrangements. *Australian Journal of Management* 47 (3): 474–502.
- Gilbreth, Lillian Moller. 1927. *The home-maker and her job*. D. Appleton.
- Glautier Michel, William Edgard, and Brian Underdown. 2001. *Accounting theory and practice*. Pearson education.
- Gomes, Francisco, Michael Haliassos, and Tarun Ramadorai. 2021. Household Finance. *Journal of Economic Literature* 59 (3): 919–1000.
- Gupta, CMA Bhogavalli Mallikarjuna. 2020. *e-Invoice the Encyclopedia for Indian GST*. Notion Press.
- Gupta, M. P., and Deepak Bhatia. 2005. Reworking with a legacy financial accounting system: Lessons from a Pharma Company. *Vikalpa* 30 (3): 79–92.
- Habib, Rima R., Fadi A. Fathallah, and Karen Messing. 2010. Full-time homemakers: workers who cannot “go home and relax.” *International Journal of Occupational Safety and Ergonomics*, 16(1): 113–128.
- Hamermesh, Daniel S., Harley Frazis, and Jay Stewart. 2005. Data watch the American time use survey. *Journal of Economic Perspectives*, 19(1): 221–232.
- Harper, Richard, and Abigail Sellen. 1995. Paper-supported collaborative work. *Rank Xerox Research Centre, Cambridge Laboratory*, 1995.
- Harper, Richard, and Brian Shatwell. 2002. Paper mail in the home of the 21st century: An analysis of the future of paper mail and implications for the design of electronic alternatives. *Interactive Marketing*, 3(4): 311–323.
- Haskins, Charles Waldo. 1903. *How to Keep Household Accounts: A Manual of Family Finance*. Harper & Brothers Publishers. <https://core.ac.uk/download/pdf/288070421.pdf>
- Hawkins, Marsha, and Marilyn Bischoff. 2003. Tracking Income and Expenses. *University of Idaho Extension*. <https://dodge.extension.wisc.edu/files/2010/06/TrackingIncomeandExpenses.pdf>
- Hayden, Dolores. 1982. *The Grand Domestic Revolution: A History of Feminist Designs For American Homes, Neighborhoods, and Cities*. MIT Press.
- Heinze, Friederike, Rolf-Torsten Kramer, and Hedda Bennewitz. 2020. Kassel-Halle-Interpretationswerkstatt. <https://www.uni-kassel.de/fb01/institute/institut-fuer-erziehungswissenschaft/fachgebiete/erziehungswissenschaft-mit-dem-schwerpunkt-grundschulpaedagogik/kassel-halle-interpretationswerkstatt>. Accessed 22 July 2023
- Helfferich, Cornelia. 2011. *Die Qualität qualitativer Daten*. Springer.
- Heritage, John. 2013. *Garfinkel and ethnomethodology*. John Wiley & Sons.
- Hochschild, Arlie Russell. 1989. *The second shift: working parents and the revolution at home*. New York, N.Y: Viking.
- Hoque, Zahirul. 2006. *Methodological Issues in Accounting Research: Theories, Methods and Issues*. Spiramus Press Ltd.
- Hurst, Erik. 2015. Measuring time use in household surveys. *Journal of Economic and Social Measurement* 40 (1–4): 177–196.
- Illich, Ivan. 1980. Shadow-Works. *Philosophica*, 26(0):1980.
- Kaye, Joseph Jofish, Mary McCuistion, Rebecca Gulotta, and David A. Shamma. 2014. Money talks: tracking personal finances. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*.

- Presented at the CHI '14: CHI Conference on Human Factors in Computing Systems, Toronto Ontario Canada: ACM: 521–530.
- Kooreman, Peter, and Sophia Wunderink. 1996. *The Economics of Household Behaviour*. London: Macmillan Education UK.
- Krantz-Kent, Rachel. 2009. Measuring time spent in unpaid household work: results from the American Time Use Survey. *Monthly Lab. Rev.* 132: 46.
- Kuhn, Gerd. 1998. Die “Frankfurter Küche.” *Bonn: Wohnkultur und kommunale Wohnungspolitik in Frankfurt am Main*, 1930: 142–176.
- Langhojer, Stefan. 2009. *Mein Haushaltsbuch 2010*. Langhojer Selbstverlag.
- Lawo, Dennis, Philip Engelbutzeder, Margarita Esau, and Gunnar Stevens. 2020. Networks of practices: exploring design opportunities for interconnected practices.
- Libby, Robert, Patricia A. Libby, and Frank Hodge. 2017. *Financial Accounting*. McGraw-Hill Education.
- Lueger, Manfred, and Ulrike Froschauer. 2022. Ethnographie und Artefaktanalyse. In eds. A. Pofelr and N. Schröer. *Handbuch Soziologische Ethnographie*. Wiesbaden: Springer Fachmedien.
- Luff, Paul, Christian Heath, and David Greatbatch. 1992. Tasks-in-interaction: paper and screen based documentation in collaborative activity. In *Proceedings of the 1992 ACM conference on Computer-Supported Cooperative Work*: 163–170.
- Luhmann, Niklas. 2005. Sozialsystem Familie. In *Soziologische Aufklärung 5*. Wiesbaden: VS Verlag für Sozialwissenschaften.
- McKemmish, Sue, and Anne Gilliland. 2013. Archival and recordkeeping research: Past, present and future. *Research methods: information, systems and contexts* 2013: 79–112.
- Mederer, Helen J. 1993. Division of Labor in Two-Earner Homes: Task Accomplishment versus Household Management as Critical Variables in Perceptions about Family Work. University of Rhode Island: *Journal of Marriage and the Family*: 133–145. <https://www.jstor.org/stable/pdf/352964.pdf>
- Mendoza, Norma A., and John W Pracejus. 1997. Buy now, pay later: does a future temporal orientation affect credit overuse? *ACR North American Advances*, 1997.
- Meyer, Erna. 2021. Der neue Haushalt: ein Wegweiser zu wirtschaftlicher Hausführung. *Leipzig: Frankfurt am Main (Deutsche Nationalbibliothek)*.
- Molina, J. A., ed. 2011. *Household Economic Behaviors*. New York, NY: Springer New York.
- Moreno-Colom, Sara. 2017. The gendered division of housework time: Analysis of time use by type and daily frequency of household tasks. *Time & Society* 26 (1): 3–27.
- Morgan, Gareth. 1988. Accounting as reality construction: towards a new epistemology for accounting practice. *Accounting, Organizations and Society* 13 (5): 477–485.
- Möser, Anke. 2010. Food preparation patterns in German family households. An econometric approach with time budget data. *Appetite* 55 (1): 99–107.
- Muralidhar, Srihari Hulikal, Claus Bossen, Apurv Mehra, and Jacki O’Neill. 2018. Digitizing Monetary Ecologies: Intended and Unintended Consequences of Introducing a Financial Management App in a Low-Resource Setting. *Proc. ACM Hum. Comput. Interact.*, 2(CSCW) 72:1-72:17.
- Muralidhar, Srihari Hulikal, Claus Bossen, and Jacki O’Neill. 2019. Rethinking financial inclusion: From access to autonomy. *Computer Supported Cooperative Work (CSCW)*, 28(3): 511–547
- Muske, Glenn, and Mary Winter. 2001. An in-depth look at family cash-flow management practices. *Journal of Family and Economic Issues* 22 (4): 353–372.
- Offer, Shira. 2014. The costs of thinking about work and family: Mental labor, work–family spillover, and gender inequality among parents in dual-earner families. In: *Sociological Forum*. Wiley Online Library. 916–936.
- Palmer, Max. 2022. The True Cost of an Invoice to Small Business Owners. <https://due.com/blog/the-true-cost-of-an-invoice-to-small-business-owners/>. Accessed 19 January 2023
- Pankow, Debra, Marsha A. Goetting, and Judith G. Ward. 1991. *Taking Charge of Family Finances: Using a Check Register to Track Your Expenses*. NDSU Extension Service.
- Perry, Mark, and Jennifer Ferreira. 2018. Moneywork: Practices of use and social interaction around digital and analog money. *ACM Transactions on Computer-Human Interaction (TOCHI)* 24 (6): 1–32.
- Piorkowsky, Michael-Burkhard. 2000. Household accounting in Germany – Some statistical evidence and the development of new systems. *Accounting, Auditing & Accountability Journal* 13 (4): 518–534.
- Primeau, Loree A. 1992. A woman’s place: Unpaid work in the home. *The American Journal of Occupational Therapy* 46 (11): 981–988.
- Pritchard, Gary, John Vines, and Patrick Olivier. 2015. Your Money’s No Good Here: The Elimination of Cash Payment on London Buses. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. Presented at the CHI '15: CHI Conference on Human Factors in Computing Systems, Seoul Republic of Korea: ACM: 907–916.

## Making Order in Household Accounting - Digital Invoices as...

- Rohde, Markus, Peter Brödner, Gunnar Stevens, Matthias Betz, and Volker Wulf. 2017. Grounded Design - a praxeological IS research perspective. *Journal of Information Technology*, 32(2): 163–179.
- Rouncefield, Mark, John A. Hughes, Tom Rodden, and Stephen Viller. 1994. Working with “constant interruption”: CSCW and the small office. In *Proceedings of the 1994 ACM conference on Computer Supported Cooperative Work - CSCW '94*. Presented at the the 1994 ACM conference. Chapel Hill, North Carolina, United States: ACM Press: 275–286.
- Rutherford, Janice Williams. 2010. *Selling Mrs. Consumer: Christine Frederick and the rise of household efficiency*. University of Georgia Press.
- Salimifard, Khodakaram, and Mike Wright. 2001. Petri net-based modelling of workflow systems: An overview. *European Journal of Operational Research* 134 (3): 664–676.
- Schmidt, Kjeld, and Carla Simonee. 1996. Coordination mechanisms: Towards a conceptual foundation of CSCW systems design. *Computer Supported Cooperative Work (CSCW)* 5 (2): 155–200.
- Schmidt, Kjeld, and Ina Wagner. 2004. Ordering systems: Coordinative practices and artifacts in architectural design and planning. *Computer Supported Cooperative Work (CSCW)* 13 (5): 349–408.
- Schmidt, Kjeld. 2000. *The critical role of workplace studies in CSCW*. Cambridge University Press Cambridge.
- Schneider, Daniel, and Orestes P. Hastings. 2017. Income Inequality and Household Labor. *Social Forces* 96 (2): 481–506.
- Searls, Doc. 2012. *The Intention Economy: When Customers Take Charge*. Harvard Business Press.
- Sellen, Abigail J., and Richard HR Harper. 2003. *The myth of the paperless office*. MIT press.
- Shankar, Kalpana. 2004. Recordkeeping in the production of scientific knowledge: An ethnographic study. *Archival Science* 4 (2004): 367–382.
- Shankar, Anita V., Ashlenn K. Quinn, Katherine L. Dickinson, Kendra N. Williams, Omar Masera, Dana Charon, et al. 2020. Everybody stacks: Lessons from household energy case studies to inform design principles for clean energy transitions. *Energy Policy*, 141: 111468.
- Snow, Stephen, and Dhaval Vyas. 2015. Fostering Collaboration in the Management of Family Finances. In *Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction*. Presented at the OzCHI '15: The Annual Meeting of the Australian Special Interest Group for Computer Human Interaction, Parkville VIC Australia: ACM: 380–387.
- Španić, Davor, Denis Ristić, and Boris Vrdoljak. 2011. An electronic invoicing system. In *Proceedings of the 11th International Conference on Telecommunications*. IEEE: 149–156.
- Star, Susan Leigh, and James R. Griesemer. 1989. Institutional Ecology, ‘Translations’ and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907–39. *Social Studies of Science*, 19(3): 387–420.
- Suchman, Lucy. 1993. Do categories have politics? The language/action perspective reconsidered. In *Proceedings of the Third European Conference on Computer-Supported Cooperative Work 13–17 September 1993*, Milan, Italy ECSCW'93. Springer: 1–14.
- Swan, Laurel, Alex S. Taylor, and Richard Harper. 2008. Making place for clutter and other ideas of home. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 15(2): 1–24.
- Swathi, Baswaraju, Abhishek Kumar, Ishu Kumar, and Vathsavi Venkat. 2020. Implementation of Improved Billing System. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, May 2020: 37–41.
- Taylor, Alex S., and Laurel Swan. 2005. Artful systems in the home. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Presented at the CHI05: CHI 2005 Conference on Human Factors in Computing Systems, Portland Oregon USA: ACM: 641–650.
- Tolmie, Peter, James Pycocock, Tim Diggins, Allan MacLean, and Alain Karsenty. 2002. Unremarkable computing. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, 399–406.
- Turner, Richard. 2003. The Myth of the Paperless Office. *New Library World*.
- U.S. Department of Labor, Bureau of Labor Statistics. 2023. *AMERICAN TIME USE SURVEY — 2022 RESULTS* (No. USDL-22-1261). <https://www.bls.gov/news.release/pdf/atus.pdf>
- United States Government, OFFICE OF INFORMATION AND REGULATORY AFFAIRS. 2015. *Information Collection Budget of the United States Government*. Washington, DC. [https://www.whitehouse.gov/wp-content/uploads/legacy\\_drupal\\_files/omb/inforeg/inforeg/icb/icb\\_2015.pdf](https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/inforeg/inforeg/icb/icb_2015.pdf). Accessed 6 December 2023
- Vines, John, Mark Blythe, Paul Dunphy, and Andrew Monk. 2011. Eighty something: banking for the older old. In *Proceedings of HCI 2011 The 25th BCS Conference on Human Computer Interaction*, 25:64–73. <https://www.scienceopen.com/hosted-document?doi=https://doi.org/10.14236/ewic/HCI2011.29>. Accessed 29 December 2023
- Vines, John, Paul Dunphy, and Andrew Monk. 2014. Pay or delay: the role of technology when managing a low income. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Presented

- at the CHI '14: CHI Conference on Human Factors in Computing Systems, Toronto Ontario Canada: ACM: 501–510.
- Vyas, Dhaval, Stephen Snow, Paul Roe, and Margot Brereton. 2016. Social Organization of Household Finance: Understanding Artful Financial Systems in the Home. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing*. Presented at the CSCW '16: Computer Supported Cooperative Work and Social Computing, San Francisco California USA: ACM: 1777–1789.
- Walker, Stephen P. 2008. Accounting histories of women: beyond recovery? *Accounting, Auditing & Accountability Journal*.
- Walzer, Susan. 1996. Thinking about the baby: Gender and divisions of infant care. *Social problems* 43 (2): 219–234.
- Webster Dictionary. 1913. Invoice | Definition of Invoice by Webster's Online Dictionary. <https://www.webster-dictionary.org/definition/Invoice>. Accessed 22 July 2023
- Whittaker, Steve, and Candace Sidner. 1996. Email overload: exploring personal information management of email. In *Proceedings of the SIGCHI conference on Human factors in computing systems common ground - CHI '96*. Presented at the the SIGCHI conference, Vancouver, British Columbia, Canada: ACM Press: 276–283.
- Winkler, Anne E., and Thomas R. Ireland. 2009. Time Spent in Household Management: Evidence and Implications. *Journal of Family and Economic Issues* 30 (3): 293–304.
- Wulf, Volker, Markus Rohde, Volkmar Pipek, and Gunnar Stevens. 2011. Engaging with practices: design case studies as a research framework in CSCW. In *Proceedings of the ACM 2011 conference on Computer supported cooperative work*. Presented at the CSCW '11: Computer Supported Cooperative Work, Hangzhou China: ACM: 505–512.
- Wulf, Volker, Volkmar Pipek, David Randall, Markus Rohde, Kjeld Schmidt, and Gunnar Stevens. 2018. *Socio-informatics*. Oxford University Press.
- Yeo, Geoffrey. 2021. *Record-making and Record-keeping in Early Societies*. Routledge.
- Zahedi, Puia. 2020. Private Dokumente verwalten - so geht's am besten. *CHIP*. [https://praxistipps.chip.de/private-dokumente-verwalten-so-gehts-am-besten\\_124069](https://praxistipps.chip.de/private-dokumente-verwalten-so-gehts-am-besten_124069). Accessed 17 July 2023

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.