Cash, Digital Payments and Accessibility - A Case Study from India

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Despite the growing interest in digitization and money in HCI and CSCW, the use of cash and digital payments by people with disabilities has received scant attention. We present findings from a qualitative study of people with visual impairments' use of cash and digital payments in metropolitan India. Using ride-hailing services as an exemplar, we find that both cash and digital payments were inaccessible to participants. We use Perry and Ferreira's "moneywork" as a theoretical framework to highlight the "added" work necessitated by this inaccessibility; that is, the work done in addition to the interactional work necessary to complete financial transactions. We argue that this "added" work is instrumental in "making" payments accessible. We discuss how ride-hailing platforms mediated collaborations between drivers and riders in relation to payments, while still making "moneywork" essential. We provide recommendations to improve the accessibility of digital payments to facilitate greater economic inclusion.

CCS Concepts: • **Human-centered computing → Empirical studies in accessibility**.

Additional Key Words and Phrases: Accessibility; Digital money; Mobile money; Mobile payments; Digital payments; Cash; Social accessibility; Social interactions; Ridesharing; Uber; Ola; Blind users

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1 INTRODUCTION

India has 63 million people with visual impairments (VI) - the world's second largest population of people with VI [62]. People with visual impairments, like people with other disabilities in the country, struggle with social and economic participation [1]. Among factors that contribute to such limited participation are attitudinal barriers [60], inaccessible workplace environments and transportation services [60], and the lack of inclusive financial infrastructures (for e.g. inaccessible currency notes [7, 61]), which make everyday transactions difficult. Removing these barriers is crucial to the wider participation of people with disabilities and their resulting notions of "financial independence" [81].

India is a cash-driven economy, with a large percentage of the country's workforce falling under the informal sector [27] where cash is the primary mode of economic exchange. Recently, however, there has been a push by the Indian government towards the adoption of digital payments as part

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of its "Digital India" vision. Digital payments, which include debit/credit cards and mobile wallets (like Paytm and PhonePe), are seen as a means to bring marginalized communities into the fold of the formal financial system. The move is also partly seen to help enhance transparency in the economy [36]. In this context, in late-2016, the Government of India undertook a 'demonetization' exercise, which resulted in certain high-denomination currency notes being banned and taken out of circulation and the introduction of new versions of other notes. Despite these efforts, a majority of transactions in the country are still cash-based [68]. Interestingly, digital payments have taken on the role of augmenting cash practices rather than replacing cash altogether. In fact, recent estimates indicate that a majority of debit card transactions were cash withdrawals from ATMs [70]. This is in contrast to many countries in the Global North where most transactions take place digitally [53, 67].

Prior work in HCI and CSCW has investigated the Indian financial technology landscape by examining the adoption and use of digital money by a range of actors including rickshaw drivers [54, 57], small business owners [59], migrant laborers [56] and rural households [41]. In this study, we extend this line of research to focus on people with visual impairments in metropolitan India. A study of their use of cash and digital payments is particularly relevant because currency notes - including those introduced post-demonetization - are inaccessible to people with visual impairments. In addition to the challenge this posed to their notions of "financial independence"[1], the inaccessibility of currency notes also resulted in online petitions to the Reserve Bank of India (India's central bank) demanding the provision of accessible currency notes [4]. Given the centrality of cash to the everyday lives of people in India, including those with visual impairments, and the increasing prominence of digital payments, we undertook this study to understand their use of cash and digital payments. Here, we draw on data from a larger study examining the ride-hailing practices of people with visual impairments [38]. In [38], Kameswaran et al. reported findings focused on theorizing people with visual impairments' experiences of "independence" resulting from their use of ride-hailing services. In contrast, this study focuses on a detailed analysis of how participants used cash and digital payments in the ride-hailing transactional context and the issues they faced when attempting to do so. An analysis of different payment methods in this context is particularly relevant because, in addition to being one of the first transactional contexts to introduce mobile based digital payments [55], ride-hailing affords multiple ways for a person to complete a transaction including via cash, credit/debit cards and mobile wallets. Research conducted in this context, thus, permits a direct comparison between the use of different payment modalities in a common transactional situation. Finally, ride-hailing allows us to understand the role of digital platforms in mediating collaborations between the customer-service provider in a service context.

Our study makes three significant contributions to CSCW research. First, to our knowledge, this is one of the first studies to examine the use of cash and digital payments by people with visual impairments. We uncover how cash and digital payments are *inherently inaccessible* to people with visual impairments and, subsequently, use the "moneywork" [63] framework to detail *the work involved in rendering them accessible*. We extend the "moneywork" framework to account for the supplementary, *hidden work* that is necessitated by the inaccessibility of cash and digital payments [54, 63]. Second, we contribute to an emerging strand of research that examines the situated use of everyday technologies by people with disabilities and highlights the social interactions involved in making them accessible [16, 17, 83]. Third, we also discuss the role of platforms like Uber and Ola in mediating rider-driver collaborations in relation to economic exchange and also offer design suggestions on making digital payments more accessible to people with visual impairments.

[1]https://feminisminindia.com/2017/10/12/demonetization-currency-inaccessible-blind/

2 RELATED WORK

2.1 Money: Meanings, Uses, Practices

Money is an artifact embedded in social relations and practices and has multiple situated meanings and uses [84]. When viewed as a means of payment, the technologies and practices around money are foregrounded and the process of its circulation leads researchers to deal with the question of infrastructures [28]. Previous studies have highlighted some key limitations associated with using cash for the general population including, issues of safety [56], effort involved in transportation and counting [22, 48] and difficulty of obtaining the exact change [42]. Digital financial technologies are often promoted with the promise of overcoming these constraints by making the payments faster and secure [12, 53, 68]. However, this discourse misses out on the technological and human infrastructures that enable digital financial transactions. These infrastructures often remain hidden from the users, just like the regulatory frameworks around them [28, 66]. Recent studies have sought to uncover another crucial aspect that has remained hidden: *the work that goes into making different forms of money "work"* [54, 57]. Perry and Ferreira define "moneywork" as "the interactional work around the use of money in making financial transactions" [63]. They draw a three-part distinction between (1) pre-transactional, (2) at-transaction and (3) post-transactional work done to successfully complete a financial transaction. A sequential analysis of the activities, actors and artifacts involved in conducting transactions provide insights into how they are accomplished in practice [34]. However, researchers have shown that the work performed around digital money goes beyond transactions themselves [24]. For example, the collaborative work involved in making digital money "usable" and trustworthy for low-literate users has been documented by [57]. Furthermore, researchers have documented the different types of "moneywork" performed by diverse users. For instance, in their study of smart card usage in Japan, Mainwaring, March & Maurer found that it was common for users to run out of balance unexpectedly because they had no way of knowing how much value they had on their cards [46]. Similar findings have been reported in the UK [65]. Insufficient balance on users' smart cards resulted in their not being allowed to enter city buses in London, where cash payments were no longer accepted. Users also could not recharge their smart cards at any place and at any time. Similarly, Airtel Money (a digital wallet service in India) users in India had to go to designated centers to convert cash into electronic value before transacting with it [57]. In this paper, we extend this line of research to examine the "moneywork" that people with visual impairments have to perform in order to *make* cash and digital payments accessible. Paying attention to the work that goes into accomplishing different types of payments will provide insights into the implications of inaccessible technologies and suggestions for designing technologies to assist with relieving "moneywork"-related difficulties amongst people with visual impairments.

2.2 Assistive Technology Research

Prior work at the intersection of Accessibility and HCI has primarily focused on the design, development and evaluation of assistive technologies for people with disabilities (for instance [11, 15]). In these studies, assistive technology operates in a functional capacity and serves to offset one's impairment, an approach set in the medical model of disability [19]. However, recently, there has been a growing interest in "social accessibility" - a body of work which examines the *situated* use of assistive and mainstream technologies by people with disabilities, as well as the social concerns of its users (for instance [52, 72, 73]), and it is here that we situate this work. This includes research examining the use of social media by people with visual impairments, which highlights the inaccessibility of these platforms and and the role of design in making them more accessible (for instance [45, 51, 85]). Another line of work in "social accessibility" details the social interactions involved in making artifacts accessible. For instance, Branham and Kane

explain how people with visual impairments work with their partners and co-workers to co-create accessible environments in homes and workplaces [16, 17]. Likewise Yuan et al. highlight how shopping is a collaborative act between people with visual impairments and their sighted shopping counterparts - the success of which is shaped by the latter's knowledge of shopping as a practice and an understanding of the ways to assist people with visual impairments [83]. Finally, Bennett et al. propose an "interdependence" framework for assistive technology design, and argue that an "interdependence" frame foregrounds the work performed by people with disabilities in creating and maintaining accessibility [13]. In this paper, we extend this line of accessibility research to examine the social interactions surrounding the use of cash and digital payments by people with visual impairments and the work done by them to make payments accessible.

2.2.1 Digital Technologies, Money and Accessibility. Prior work at the intersection of digital technologies, money and accessibility has centered around the design of technologies to 1) assist people with visual impairments in identifying cash and 2) improve the accessibility of ATMs. The ubiquity of smartphones equipped with cameras has resulted in research examining ways to improve the speed and accuracy of currency note detection (for e.g., [44, 58]). On the other hand, early work examining the accessibility of ATMs focused on enhancing the usability of ATM user-interfaces [21, 47, 47] while more recent work has turned towards building accessible ATM experiences from the ground up, taking into consideration the needs of people with visual impairments [20, 64]. For instance, Pous et al. propose a design which turns a "more accessible" device like a feature phone into a remote control which, then, allows one to withdraw cash in an ATM without a card [64]. Singanamalla et al. adapt this design to make it more relevant for the Indian context [74]. They extend Pous et al.'s design to include smartphones which can be used to pre-authorize cash withdrawals. Finally, Ahmed et al. uncover the privacy challenges that people with visual impairments face in ATMs and detail how making information about people in their vicinity available can improve their sense of security [10].

In contrast, fewer studies have focused on the use of cash and digital payments by people with visual impairments. With regard to digital payments, Kiiti and Mutinda [40] report on the use of M-PESA, a feature phone-based mobile money application, by people with visual impairments in Kenya. M-PESA was 'inaccessible' as participants did not have screen readers on their phones which meant that, in order to to conduct transactions, they had to share sensitive information like PINs with others, resulting in cases of fraud. This problem was exacerbated by the fact that M-PESA was users' main store of value, containing almost all their savings. This study highlights the importance of making digital payments accessible to people with visual impairments. Furthermore, we note a lack of prior work which compares payment modes in terms of accessibility and work required to facilitate transactions. Hence, we examined the use of cash and digital payments by people with visual impairments in India in a common transactional context - ride-hailing.

3 METHODS

We draw from a larger qualitative study examining the ride-hailing practices of people with visual impairments in metropolitan India [38]. The study was conducted between June - August 2017. Participants were recruited via Access India - an online list for people with disabilities in India (n=15), personal contacts (n=6), and snowballing (n=9). Interviews were semi-structured and lasted for approximately 60-75 minutes. These included a combination of face-to-face and Skype/phone conversations. Amongst other topics, interviewees were asked about their preferred mode of payment, reasons for their choices, challenges they faced with the payment process, and how they circumvented these challenges. Participants were compensated with a Rs 250 ($4) voucher for their time. Interviews were conducted in English as all participants were familiar with it. Interviews

were audio-recorded, for which informed consent was obtained prior to the start of the interview. Interviews were transcribed verbatim by the research team. The interviews gave us rich, in-depth narratives [43] about the use of cash and digital payments by participants. Data pertaining to cash and digital payments was analyzed through a three-cycle coding process which included both, a bottom-up, inductive process for the first two coding cycles, then a deductive process in the third cycle. In the first cycle, we used descriptive codes [69] to identify "topics" about payments and payment modes. In the second cycle, we used "pattern coding" [69] to organize and group the descriptive codes under specific themes. At this stage, we identified eight themes including: (1) reasons for cash usage, (2) challenges with cash usage, (3) advantages of digital payments, (4) disadvantages of digital payments, (6) social implications resulting from the use of digital payments, (7) cash-related workarounds, and (8) digital payments-related workarounds. In the third coding cycle, we grouped data coded under the cash and digital payment workaround themes under three codes based on the "moneywork" framework's [63] distinction between transaction phases i.e. (1) pre-, (2) at- and (3) post- transaction to understand the times in which the workarounds occurred.

In contrast, in the larger study on ride-hailing [38], we focused on a subset of data pertaining to experiences of independence. In [38], we inductively coded for autonomy, control and reciprocity - themes related to independence which were based on prior literature while deductively we grouped data under the different phases of a ride-hailing trip including - booking, the first 100 meters, cab journey, payment and the last 100 meters. Grouping data under these trip phases allowed us to dig deep into the independence related tensions that emerged during each phase.

4 PARTICIPANT DEMOGRAPHICS AND CONTEXT

Participants in the study were between 24 and 53 years old. 24 men and 6 women were interviewed in total. Participants were recruited from eight metropolitan cities in the country - Bengaluru (n=11), New Delhi (n=10), Kolkata (n=2), Chennai (n=2), Mumbai (n=2), Pune (n=1), Lucknow (n=1) and Guwahati (n=1). All participants identified as totally blind. Most were Android phone users (n=25), which is in contrast to prior work in accessibility in the Global North, where a majority are iPhone users [50].

In the ride-hailing context in India, payments can be made via multiple modes. These modes can classified broadly into (1) cash and (2) digital payments, the latter including both mobile wallets like Paytm (in Uber) and Ola Money (in Ola) as well as credit/debit cards. Cash payment entails a handover of currency notes and coins to the driver upon completing a ride and often collecting the necessary change back.

Mobile wallets such as Paytm and Ola Money are linked to the user's bank account via their debit/credit card and allow them to store a certain amount of money, which can, then, be used for transactions. Paytm and Ola Money are embedded in the Uber and Ola apps respectively. Riders who prefer to pay by these m-wallets need to maintain a minimum balance to pay for the ride, failing which they have to either recharge their wallet on-the-go or pay by cash. Upon completing a ride, the fare is deducted automatically from this balance. There are costs associated with moving the money stored in the wallet to their linked bank account.

For added context, Paytm and Ola Money also operate as separate apps which work differently. For instance, Paytm is an app that interfaces between businesses (like shops) and its customers. Here, to transact using Paytm, one has to open the Paytm app and scan a QR code (which is unique to every business and often made visible on the storefront) using the smartphone camera and, on successful detection, the price is deducted from the balance. Finally, credit/debit cards are also linked to the ride-hailing apps (Uber). In India, online (including mobile) card payments require two-factor authentication. First, the user has to confirm the card payment, by entering the CVV code (the three digit code on the back of the card), after which they receive a One-Time Password

(OTP) to the registered mobile phone, which, then, has to be entered to confirm the payment. The user typically has 180 seconds or less for authentication. Lastly, the user can pick either cash, digital wallets or cards (in the case of Uber) *prior* to the start of a trip and, at the time of the study, neither app allowed the user to change the mode of payment once the ride had been booked.

5 FINDINGS

5.1 Cash

5.1.1 Preferences and Use. Out of 30 participants, three expressed no strong preference for either, cash or digital payments, whereas three others preferred and used only digital payments. Among the remaining 24, 12 preferred to transact by cash, whereas the other 12 preferred digital payments but had to sometimes use cash for reasons delineated below. The participants who transacted mostly by cash attributed their use to factors such as: their familiarity and widespread preference for physical forms of money in a cash-driven society, lack of trust and difficulties with digital payments, and the immediacy of cash exchange.

Cash is deeply entrenched in India and central to everyday financial practices of people at large, including those with visual impairments, some of whom saw no reason to move to digital payments as they had grown accustomed to using cash over time. Others felt that the shift from cash to digital was simply not "worth it," and that it was too much of a "hassle." Using digital payment apps required becoming familiar with a new user interface. This entailed significant work on their part as it required them to determine the application's compatibility with their phone's screen reader, and, to understand how it interacted with the different screens of the app. This was exacerbated by the limited accessibility of mainstream everyday apps. For instance, unlabelled buttons are inaccessible as they are not called out by screen readers, making it impossible for people with visual impairments to identify the function/task they represent by themselves. As one participant explained,

> "Although I have been planning to do a Paytm for a while now, but with just adding more technology and sitting and then having to link it to your bank and all of those things - it's too much for me [...] there are certain - a few accessibility challenges with Paytm as well apparently [...] and I don't want to add to my headache [...] It's just simplest if I know how much I have to pay [...] I keep my money separated in my wallet. I know what I need to deal with, what notes I need to take out and give and things like that. So, it sort of makes it easier". - P37

Whilst some participants saw cash as a "win-win" situation for both the driver and themselves, others felt that using cash was a compromise that they had to make in order to avail a service, in this case avail an Uber or Ola cab. One participant explained his perception of a "win-win" as follows:

> "Even the driver is also happy if I give him the cash [...] that day's expenses for him will happen, right? I am thinking from that angle." - P9

The desire to avoid conflict and the need to travel, thus, shaped participants' cash usage. The driver's preference for cash meant that the choice pertaining to a means of payment did not entirely rest with the customer, sometimes putting the two transacting parties' preferences at odds. However, some participants were happy to use cash because they did not trust digital payments and were concerned with the privacy and security of online transactions - which has been highlighted by prior work [9, 10, 35, 74]. P10 noted how his friends with visual impairments had stayed away from Uber and Ola because they associated app-based taxi hailing with digital payments.

> "They think their money could be stolen etc. So, they always try to avail the cash [...] cash payment [...] even their booking something [...] something from any online shop etc. So, in that regards, as I have said earlier, some of my friends from junior - they did not know direct cash payment is available while booking Ola or Uber, so they were little bit of [...] you know [...] hesitant to book that." - P10

On the other hand, among participants who had used both cash and digital payments, some cited the relative advantages of the former by drawing comparisons with the latter. For instance, some participants voiced concerns about transaction costs associated with digital payments. Cash settles at par and involves no service charges, whereas this is not the case with digital alternatives, whether card- or mobile-based.

> "Why should I keep the money in the Paytm guy who doesn't pay me anything at all? No interest, nothing, and he's earning a lot, and for everything, every transaction, he transacts [deducts] 5 percent or 2 percent [...] why should I make a payment to that guy for a digital platform? See, my hard earned cash I have earned it with all my sweat and blood, and I put it into the bank - if he gives me 2 percent or 3 percent interest, it is fine. But if I have put it into Paytm that money, he is not going to give me interest." - P9

Concerns about losing money was a consistent theme with our participants. In India, like much of the Global South, disability is correlated with lower incomes and many people with disabilities receive little formal education and are unemployed [1]. Even those with jobs - like many of our participants - earn significantly less than their able bodied counterparts which likely explains why these concerns surfaced in the first place [1].

Moreover, participants perceived cash-to-digital conversion as a challenge and cumbersome. In India, where cash is the dominant mode of economic exchange already, immediate access to cash for some meant that it was easier to conduct transactions by cash than change it to digital forms of money and then transact with digital money. For instance, P33 reported that a part of his income was earned in cash from his students who paid him for coaching classes. Consequently, it was more convenient for him to circulate cash at-hand as opposed to visiting banks or ATMs to deposit it and then use debit/credit cards. Not only was this perceived as a roundabout way of doing things, but banks and ATMs in India are also mostly inaccessible for people with visual impairments [74], resulting in a preference for cash. Evidently, such a process also necessitated people with visual impairments travel to banks or ATMs in the first place - which can be challenging in metropolitan India, where there is limited accessible infrastructure (for instance - many roads lack sidewalks and public transportation is also inaccessible [38]).

5.1.2 Challenges with cash. Notwithstanding these benefits, our participants' accounts indicated that cash was not *inherently* accessible, but rather it had to be rendered "accessible" through work.

5.1.2.1 Cash Identification. Since neither notes nor coins are easily identifiable through touch, participants found it difficult to distinguish between different denominations.

> "Cash is not accessible. I couldn't differentiate Rs. 100, Rs. 500 [...] in this days, RBI had printed coins in accessible mode. Rs. 5 coin will be little more thick, Rs. 10 coin will be less - those things are abolished now, everything looks [feels] the same. Even Rs. 100, Rs. 500 [...] I have to put the note side by side, I have to measure the length." - P12

Although participants relied on the length of notes to distinguish between different denominations, new notes circulating after India's implementation of the demonetization policy introduced new difficulties because the length of the new notes were no longer proportional to the denomination. If given enough time, several participants felt that they could distinguish between denominations,

but some reported that it was impossible to identify whether or not the notes were fake. Only one participant, who was a bank official, pointed to markers embossed on currency notes.

> "Thin lines are there, braille lines - Rs. 2000 has seven lines and Rs. 500 has four and Rs. 100 three." - P7

It ought to be noted that, although P7 referred to those markers on the currency notes as "braille lines," there are actually no braille lines on Indian currency notes. These markers are instead used to identify authentic currency notes as opposed to fake ones. None of the other participants were even aware of such markings, and moreover, P7 did not rely on them himself when transacting by cash.

> "Those marks you can make out, but I do not depend on that. Truly I do not depend on that thing. Length wise we can make out, we can keep it and measure it. That one option is there" - P7

In transactional contexts, there is often a short time window in which to complete a transaction, which makes locating markers and identifying notes difficult. This brings us to another problem that people with visual impairments encounter with cash - that of obtaining and verifying change.

5.1.2.2 Collecting Change. As cash identification was difficult through touch, participants were dependent on drivers to assist them with identification and to inform them if the notes handed over to them were too large or small. In fact, some participants also asked the driver to communicate the final price of the trip to them (which could differ from the initial estimate indicated by the app), likely because using a screen reader to move across the user-interface sequentially to read the price of the trip was time-consuming.

> "Sometimes I have no record how much money I have and there is no time to check the notes by myself - to take all the notes out and check the size, there is no so much of time for all this - then I take the help of the driver and pay" - P22

Needless to say, participants also expected the driver to hand back the right change as there was little to no time to verify. Sometimes, they had to step out of the cab themselves and seek change from pedestrians or shops in the vicinity. Although these encounters are not unique to people with visual impairments, the effects are magnified for them, and seeking assistance can be particularly difficult in unfamiliar locations.

> "But I think 2 months back, recently, we faced the challenge that we gave him Rs. 500 and he was saying that he doesn't have change. So we said that [...] please get a change [...] so he was saying it that time no, you have to get the change [...] so literally we have to just get out of the cab to the shops and we have to collect the change and then we have to give it to the driver." - P30

In relation to collecting change, participants were frustrated by the introduction of large denominations in the post-demonetization period in India. For instance, they questioned the logic of introducing large denominations like Rs. 2000 in the place of Rs. 1000 as it made it harder to obtain change. Furthermore, exigencies such as the need to complete a transaction as soon as possible, as noted above, shaped their preferences. For instance, although some of them knew about and used apps like Moneytell to assist with note identification, they reported that scanning one note after another at the time of transaction was time-consuming and difficult. That they had to repeat the entire process if/when the driver returned change meant that scanner apps were simply impractical for this type of transaction. Participants could neither manually cross-check each note, one at a time, nor use apps to scan them and verify, which meant that they were invariably dependent on drivers.

> "I can identify from the sizes of the notes, a little bit I can anyway identify but I don't really sit and cross check. If there are some 5-6 notes being given back to me, I don't really sit and cross check." - P36

Participants expected the driver to act in good faith, and, on most occasions, their trust was not misplaced.

> "[...] I did hand a Rs. 500 note to a cabbie instead of a Rs. 100 note and he thought I was asking for change and he told me no change. Then I figured I had given him a Rs. 500 note [...] if I have to take change from them, I have to trust them." - P37

That said, participants neither liked the fact that they had little choice but to trust the driver, nor had they always had positive experiences. Drivers were a mixed bunch and some took advantage of our participants' disability, getting away with the money that was offered in the initial handover.

> "I use cash payment as well. Sometimes. Yes. A few drivers [...] they don't give a damn about my vision impairment. Whatever I have given to them, they just accept it and run away." - P29

At a more general level, participants voiced concerns about keeping large amounts of cash with them during a ride as they were concerned about their safety. They were anxious about their money and other belongings being stolen during the course of the ride, by drivers or fellow riders in case of shared rides.

5.1.3 Making Cash "Work". Although our participants saw some practical reasons for using cash, it is clear that they also experienced difficulties with respect to its accessibility for the reasons delineated above. It is, therefore, vital to investigate how our participants rendered cash 'accessible'.

Earlier, we noted that the identification of currency notes was a major challenge for people with visual impairments in transactional contexts that involved time constraints. These factors necessitated that they engage in adequate work in terms of organizing and managing their money. This involved participants using different spaces, such as different pockets or folders in a wallet.

> "Right from the beginning - I have this habit of, since I had this vision, I had this note size and keep it in my mind or whatever it is, and before I go home, I have this habit of checking with the people what is the money I am taking. I invariably have this habit of keeping the highest denomination note at the back, like Rs. 2000 at the back, then the Rs. 500 note, and then the Rs. 100 note [...]." - P9

Participants often accomplished this preparatory work with the assistance of family members and friends. The desire to avoid the problem of collecting and verifying change was a key reason that led them to engage in this work.

> "I have helpers - my mom used to give me exact cash [...] she would put money in the shirt pocket, I used to pay exactly. But it's not possible when I am in somewhere I have to travel [alone] urgently." - P12

Here, a key technology affordance that assisted participants with this preparatory work was the fare estimate feature on the Uber/Ola application. The information provided beforehand helped them to arrange the cash amount required for the trip, which they segregated and kept aside from the rest of the cash they carried. Although the exact final fare would often vary from the initial estimate, participants using this approach reported that the difference was small and manageable. Another affordance that technology provided in this context was customer support. Participants appreciated the fact that they could now relay any negative experiences and potentially get reimbursed in case of fraud by drivers. Furthermore, concerns over being defrauded and safety around carrying

cash on a more general level resulted in additional work in terms of precautionary measures. One strategy was to limit the amount they kept on person at the time of taking Uber/Ola rides.

5.2 Digital Payments

Approximately half of our participants preferred digital payments as they reduced the work involved in using cash. We first address some of the perceived advantages amongst these participants. However, as they noted, using digital payments was not without its challenges, and we delve into the characteristics of credit/debit cards and mobile wallets that made them inaccessible.

5.2.1 The Advantages of Digital Payments.

5.2.1.1 Practical Benefits. Participants saw several practical reasons to adopt digital payments like Paytm and Ola Money. Those who preferred digital payments noted that they allowed them to do away with their work at the time of the transaction, especially with respect to the twin problems of currency identification and collecting change. It sped up the payment process whilst also making it more convenient.

The second major reason highlighted was the ease of use. The fare, algorithmically determined by the app, eliminated the need for any haggling with the driver. The immediate deduction of the fare from the embedded mobile wallet upon the completion of a ride meant that there was a reduction in the work involved.

> "It's easier to make payment at the end [...] - at the end, once you finish your trip, it will just ask - pay now, pay using Paytm. I just say pay using Paytm and one click of a button and the payment is made." - P2

Additionally, the automatic fare calculation and deduction meant that there was reduced dependence on others such as family members and, most importantly, the driver at the time of transaction. This made some people with visual impairments feel more self-reliant. Digital payments also eliminated the need to seek information from the driver about the actual, final fare for the ride. There were also fewer concerns about being cheated by the driver. This possibility, they said, did not arise in case of digital payments.

> "[...] Ola Money or credit card [...] so it automatically gets deducted [...] the amount. So, the driver cannot, you know, cheat [...] otherwise not only cab service, I avoid cash transactions. Most of my transactions, I do e-transactions only, wherever possible." - P32

Furthermore, participants reported that they felt more at ease, in general, because they no longer had to carry around large amounts of cash with them during their rides. In addition to practical reasons, there were larger social implications that stemmed from the use of digital payments, which participants highlighted as being key advantages.

5.2.1.2 Social Implications. Kameswaran et al. note that one of the key advantages that people with visual impairment experienced with app-based ride-hailing services was the increased independence they enabled [38]. People with visual impairments were able to go out and about more, with reduced need for assistance from others, which was not possible previously with other modes of transportation. This enhanced sense of independence was made possible by several affordances of ride-hailing platforms such as the possibility of booking rides via a mobile phone, assistance with navigation through maps, and the offer of digital payments.

The perceived self-reliance that resulted from the use of Paytm contributed to participants' sense of independence, which prior work suggests is a central value that people with disabilities seek from technology interventions [82].

> "I need not ask so many peoples help - so independence it has increased and payment issues also, digital cash mode 'it has made us independent [...] whatever amount I want I can recharge into my wallet and pay it easily. I need not worry about the safety of my money [...] So cash wise and traveling wise they have made us independent [...] it has increased our pride, it has increased our prestige before outside world [...] It improved our confidence, it has improved others' confidence." - P12

Here, we also see the role of technology, specifically digital financial services, in enabling people with visual impairments present themselves [31] as competent members of society, through everyday interactions [26] - in this case by being able to handle financial transactions by themselves. With cash, participants were concerned about the potential embarrassment resulting from handing over incorrect cash/denominations to the driver.

> "Most of the time, we prefer Paytm or debit card because one - its very easy, and second we may sometimes end up giving more money to the driver or we may even give him less money and it might be bit embarrassing." - P16

Thus, in addition to the practical benefits, we see that digital payments helped participants avoid the social costs which people with visual impairments might incur when using cash.

5.2.2 Challenges with Digital Payments. Despite their practical benefits and role in fostering an increased sense of independence, digital payments were not necessarily the default mode of transaction. The choice to adopt and use mobile wallets or cards was neither automatic nor obvious. Below, we highlight some challenges that our participants experienced with using digital payments, pointing to issues related to accessibility, and platform design.

Very few participants used debit/credit cards to pay for their rides and many spoke at length about the inaccessibility of cards in general. There was no way for people with visual impairments to determine card details such as number, expiration date and CVV, all of which are required to authenticate an online payment. Although cards have certain details in a raised, embossed format, participants noted that this was often insufficient. Using cards, therefore, required remembering the card details, a challenge exacerbated when they possessed multiple cards. As this participant explains, cards were made accessible by seeking help from familiar people around.

> "P28: That is the I had to like read out the someone like I have to give this card to someone and then..
> Interviewer: So you took help from someone?
> P28: Yeah yeah I took definitely because there is no like there is no any another way for that.
> Interviewer: Every time you have to enter your debit card no. you ask someone to read it out?
> P28: Yeah yeah. I have to take the help of someone, someone's help then I go to [...]
> Interviewer: What about the CVV number? Do you remember it or do you like..
> P28: Most of the time I remembered. Even I remembered my card no. Because like there is no possible that someone like lots of time, many times someone just like you have to find the peoples and then you have to need the help."

Others reported that saving their card details on the apps helped reduce their dependence on others and the need to remember the details. Although helpful, this did not eliminate the work involved altogether because card payments in India are a two-step process. Upon entering the card details, the user receives a One-Time Password (OTP) for authentication. Whilst Uber and Ola allowed the users to store their card details, step two was still difficult. When people with visual impairments receive an OTP in the form of a text message, they are required to switch apps, listen

carefully to the screen reader read out the OTP, remember it, switch back to the browser/payment gateway window, and enter the details correctly to authenticate the payment. Some participants noted that listening to the OTP and going through the process step-by-step was burdensome in crowded, public spaces with a lot of noise and disturbance. Participants were anxious about not being able to hear the OTP correctly or making mistakes while typing it because they had a short time period to complete the transaction. At the same time, the costs of making a mistake were quite high. Three incorrect entries would result in their card being blocked by the bank. This led people with visual impairment to prefer mobile wallets over cards.

A key prerequisite for mobile wallets to be usable was for their primary features and screens to be accessible to screen readers on the participants' smartphones. The fact that Paytm was embedded into the Uber app played an important role in rendering it accessible to screen readers. In contrast to this, unlabeled buttons prevailed in the Ola app, which, in turn, forced participants to resort to cash.

> "For Uber, I use Paytm. And Ola, I use cash. While exploring the Uber app, I got the function payment [...] you can link your Paytm a/c with this, ok, so I attached that myself [...] I tried once recharging my Ola Money account with my card, but, again, it's an ally (accessibility) issue. Like, you can't click on Ola Money while using voiceover in iPhone. So, that's why I prefer using cash with Ola." - P27

In this case, it is evident that, although the user preferred digital payments, the poor design of the Ola app, including its m-wallet Ola Money, meant that he had to resort to cash, despite difficulties. At the same time, it is important to note that Paytm itself was *made* accessible by its embedding in the Uber app. Some participants remarked that Paytm was not accessible when used as an independent app in other contexts. This was because it involved steps such as locating the QR code of the service provider and scanning it, which they found impossible to undertake by themselves.

There is considerable work that goes into making m-wallets accessible. Although they allow the user to link bank account or debit/card to the m-wallet account, work needs to done in terms of regularly loading money onto the wallet before using it for a transaction. Recharging a wallet entails the same process as a card payment - confirming the CVV of the card linked to the wallet and then entering the OTP. Again, whilst possible in the fullness of time, many participants noted how recharging it was difficult on-the-go. Often participants noticed the need to recharge at the time they required an Uber or Ola ride, as rides cannot be initiated without a minimum balance on their wallets. Furthermore, something that made digital payments problematic was that any balance leftover in the wallet could not be transferred back to the user's bank account for free. The user is charged a certain fee for transferring their m-wallet balance. This led to some participants comparing the unused balance in a Paytm/Ola Money wallet to savings in their bank account in terms of how the lack of any return i.e. interest on stored balance in the case of the m-wallet, unlike the bank account, put them at a disadvantage.

Finally, there were privacy concerns about using cards in unfamiliar spaces where participants were uncertain about who was in their immediate vicinity.

> "So if there is a way I ask Google to book for me - so it would be very very easier to us and more and more blind person can avail this service. Blind person is frightened to type on the road and some of them also believe that while he is typing credentials or card number, someone can see it. So that is why they try to avail the cash and try to you know." - P10

Screen readers are essential for people with visual impairments to use mobile apps - but in this transactional context, screen readers reading out card numbers aloud, in fact, increased privacy

risks necessitating the use of headphones or earphones to minimize these risks. For many, cash was, thus, a more convenient option.

6 DISCUSSION

6.1 On Moneywork

Perry and Ferriera propose "moneywork" as a framework for understanding the interactional work involved in using cash and digital payments [63]. The framework organizes "moneywork" into three phases: (1) pre-transaction, (2) at-transaction and (3) post-transaction, referring to the activities that people undertake before, during and after transactions. In our study, we found that neither cash or digital payments were inherently accessible to people with visual impairments, and we use the "moneywork" framework to highlight the work that people with visual impairments put in to overcome the challenges resulting from this inaccessibility. We argue that this "added" work - work done on top of the transaction-related activities detailed by Perry and Ferriera [63] (for instance, maintaining and readying payment devices) - is critical to "making" different forms of money accessible for transactions.

6.1.1 On Cash. Cash is inaccessible because of the difficulties in distinguishing between currency notes of different denominations, especially with notes introduced post-demonetization, which are not proportional to the length of the notes. Distinguishing between notes was time consuming and almost impossible when there is a limited time window to complete a transaction. Like Perry and Ferriera's participants [63], our participants too organized their activities with the objective of accomplishing the transaction as rapidly and smoothly as possible upon the completion of a ride.

Pre-transaction: As described, two preparatory activities are key in this phase: (1) organizing currency notes and, (2) (in some cases) obtaining help to assist with organizing. The latter involved collaborative work with friends and family and was contingent on obtaining the right help at the right time. Trust, although not stated by our participants likely played an important role in determining whom they sought assistance from, given the potential implications on one's sense of privacy and security. Importantly, our participants didn't report these collaborations as impinging on their sense of independence, likely because of the lack of other ways to work around the challenge of inaccessible notes, which made seeking help a necessity.

These pre-transactional activities constitute "articulation work" - a set of activities that enable financial transactions by making cash accessible. Strauss defined articulation work as "the specifics of putting together tasks, task sequences, task clusters - even aligning larger units such as lines of work and sub-projects in the service of work flow" [75]. This articulation work allowed participants to prepare for a smooth at-transaction cash exchange process through an organized set of tasks. Although Perry and Ferreira introduced digital articulation work [63] which is the work performed to prepare digital devices for a transaction, a unique insight offered by this work is that such articulation work extended to cash as well. Finally, also a part of cash use are concerns over one's personal safety and cash being stolen, resulting in participants limiting the cash they carried with them.

At-transaction: The at-transaction work involved (1) recalling the specific locations of currency notes (organized in the pre-transaction phase) and (2) collecting and verifying change. The first step was made difficult by the time which elapsed between organizing notes and actually spending them, which led to step (2), which, in turn, entailed collaborative work with the driver. Participants expected drivers to assist with the cash exchange process - telling them if they handed incorrect denominations and in handing back the correct change. The limited time window available to complete a transaction resulted in an inevitable dependence on the driver, i.e. participants did not always trust them, but had little choice. Thus, by identifying notes, telling participants about

the price of the final trip, and in handing back change, the drivers too played a part in rendering cash accessible by collaborating with our participants to complete the exchange. Finally, these collaborative acts necessitated that either riders or drivers have the right currency denominations to complete the transaction. If either did not - the onus was on the rider to acquire change in the cumbersome manner described in the results.

Post-transaction: Drivers were a mixed bunch and some participants reported having been cheated by them. Here, customer support - an affordance of Uber and Ola - allowed for post-transactional work and, as a result, participants were able to report complaints (email/message through the app in Uber versus customer support line in Ola). Although the pre-transactional and at-transaction activities with cash likely extend to other transactional contexts, the post-transactional work is unique to technology-mediated platforms (ride-hailing, online delivery, and so on).

6.1.2 On Digital Payments. Like cash, digital payments too necessitated work in the pre- and at-transactional stages although the nature of these activities and associated work varied between mobile wallets and credit/debit cards.

Pre-transaction: The pre-transactional activities for mobile wallets and cards included: (1) ensuring there was sufficient balance in the mobile wallet to initiate a trip and (2) seeking help to enter and store card numbers in the app. The first required topping up if there was insufficient balance, which some participants found difficult to do when they needed a ride immediately, since apps typically notify that *after* the process of booking a ride has begun. To work around this, participants switched payment modes - most often to cash to initiate a trip.

Both, debit or credit cards were inaccessible to people with visual impairments (as they were not perceptible by touch) and required collaborative work to overcome the challenges. Although in many cases step (2) was a one-time effort, some of our participants highlighted the work associated with entering card details on other web/mobile apps.

At-transaction: The at-transactional work was significantly reduced with mobile wallets because of automatic deduction. On the other hand, cards necessitated: (1) entering the CVV and confirming a One Time Password - an alphanumerical message sent to a cellphone as part of the two-factor authentication unique to India. Participants highlighted that listening to the OTP was difficult in noisy and crowded environments, which prior research in accessibility categorizes as "situational impairments" - contexts that designers ought to consider while designing accessible technologies [39, 77, 78]. In addition to the process being time-consuming, the cost of entering details incorrectly was also high i.e the risk of suspended bank accounts or blocked cards. It is a combination of the pre- and at-transactional work associated with cards that dissuaded participants from using them altogether - evident by very few participants using them. Further, cash is inaccessible as well - which meant that in the ride-hailing transactional context, more specifically Uber (as Ola and Ola Money were deemed inaccessible), some of our participants found Paytm to be the ideal payment mode. Much like participants in Perry and Ferriera's study [63], the use of digital payments has associated social implications too - like the enhanced sense of independence and reduced likelihood of embarrassment from handing incorrect notes. However, in spite of our participants' preference for mobile payments, we also saw that they often had to account for the drivers' preference (for cash) and this too shaped their use of payment modes - a discussion which is incomplete without understanding the role of the platform in mediating the collaborations between the rider and driver, which we address in the following section.

6.1.3 In summary. We agree with Mainwaring et al. that "keeping e-money running smoothly required work from people who use it" [46] and extend the argument to cash use as well. Prior work has examined the challenges with cash including issues of safety, counting and obtaining change [22, 48, 56]. Although we observed these challenges with our participants as well, in

many cases, they were magnified - because of the inaccessibility of these payment modes that necessitates "added" work on their part to render them accessible. A large body of work on digital financial technologies has focused on the at-transaction moment i.e. the usability of payments including how they can be made faster and more secure [12, 53, 68]. However, as we show, there is considerable work involved in making payments accessible - at the pre-, at- and post-transactional moments, some of which necessitates collaborative work between people with visual impairments and family, friends and the driver suggesting that payments are actually "embedded within wider socio-technical ecosystems" [57]. In doing so, and examining other work involved in making cash and digital payments accessible, we extend CSCW research that examines the "hidden" work involved in making payments usable [54, 63].

Likewise, a majority of work in accessibility focuses on the design of technologies to assist with functional needs of people with disabilities (for instance [14]). As Thieme et al. argue, these technologies "are often treated in isolation from the wider social contexts in which they occur" [76]. In contrast, we highlight the work done by people with visual impairments, including how social interactions and collaborations are key to *making* payments accessible.

6.2 Platform Design and Collaborations

Platforms such as Uber and Ola position themselves at the centre of a controlled, closed ecosystem and mediate not only the interactions between drivers and riders, but also the collaborative work that they perform, including the payment process. One of the major problems with "gig economy" platforms is information asymmetries, resulting from the non-inclusive design of the ecosystem (not just the app) that can that can exacerbate existing tensions [32]. For instance, Kameswaran et al. note how the lack of information about customers' disabilities impedes the driver's ability to assist them [38]. In the context of economic exchange, it is imperative that the two transacting parties are in agreement with respect to the terms and means of exchange. Without probing into why drivers might be reluctant to accept Ola Money or Paytm, merely thinking about the different ways of "persuading" or "enforcing" drivers to accept digital payments will be unhelpful. Previous studies looking at digital money have examined individual users and highlighted individual-level explanatory factors such as literacy levels [49], trust [79] and privacy concerns [80]. Our findings reveal that economic exchange in the case of people with visual impairments entails collaborative work raising questions such as what it means to exercise independence or autonomy (in the context of collaborations).

Furthermore, the workarounds our case illustrates (such as using cash because of driver preferences for the same) echoes the findings by [55], who argue that *it is the very design of the platform* that explains why drivers are reluctant to accept cashless payments. First, the platform design does not allow a rider to change the mode of payment once selected, leaving no scope to negotiate or accommodate driver preferences. Platforms, by design, limit the interaction that customers directly have with workers/service providers; this has been noted as an issue across digital labour platforms, from Uber to Amazon Mechanical Turk [32]. In the ride-hailing context, studies on Uber in the Global North [30] also indicate that cashless payments from the rider are first routed to the platform's account, and, then, transferred to the driver's bank account. This electronic bank transfer process can take anywhere between one day (Ola) to a week (Uber). Consequently, drivers cannot access their digital earnings in real-time or use them to attend to their day-to-day needs, thus explaining their strong preference for cash. Having no stable income, and facing uncertainty about the number of rides they get on any given day [8], they prefer not to accept cashless payments.

The impact of platform design on the "moneywork" done by customers is relevant across gig economy platforms. For instance, recently, DoorDash and InstaCart in the US were found to

subsidize delivery workers' earnings with customer tips [2]. Digital payments played a crucial role in enabling them to do this. The platform is, in principle, typically expected to pay either on an hourly basis or per task. Any tip that the customer might provide is an add-on and is generally understood as a token of appreciation for a job well done. However, digital payments, in this ecosystem, enabled platforms to pay lower worker wages. This led to workers requesting the customers to tip in cash so that they could earn their full wages and ensure that there are no deductions made on the tip. This is similar to what drivers expect in the context of Uber and Ola in India, although the reasons might be slightly different [55]. These examples ask us to reflect upon the possibilities that technology enables in terms of exploiting poor labour and wage regulations in emerging markets. They illustrate the larger issue with platforms - their design is inscribed with their own business logic [29] - as opposed to seriously taking into consideration different stakeholders' interests and creating an inclusive, equitable ecosystem - the importance of which has been highlighted by prior work on ride-hailing services [18, 23, 30, 37].

6.3 Situating payments in India

In India, much like most countries across the world, cash and digital payments work alongside each other as means of economic exchange. However, unlike many countries in the Global North and like most countries in the Global South - cash is the primary mode of economic exchange [68] and integral to the everyday lives of people, and people with visual impairments are no exception to this. However, cash and digital payments are both inherently inaccessible to people with visual impairments and require additional work on their part to *make* them accessible.

The social model of disability provides an analytical framework to understand the exclusion and subsequent marginalization of people with disabilities [71]. The social model distinguishes between "impairment" and "disability," and whilst the former is defined by the lack of functional ability, disability is understood as the result of structural barriers which excludes people from participation in mainstream social and economic activities [71]. Using the social model as a lens, it is easy to see why the inaccessibility of cash and digital payments is disabling and exclusionary as it makes participation in economic activity - a key aspect of everyday life - difficult. In reality, economic activity is only one facet of everyday life from which people with visual impairments in India are excluded [1]. The lack of accessible transportation, educational institutions and work-place environments also impede mainstream participation - challenges which are compounded by prevailing negative attitudes towards people with disabilities [60].

Notable here is the role of the state in ensuring the accessibility of financial infrastructures and driving inclusion. In response to the call by people with visual impairments for designing currency notes to be accessible [4], the Reserve Bank of India (the country's central bank) announced the future release of an app to assist with the identification of currency notes[6] - which our research suggests will not necessarily be useful, much like other money scanner apps [44, 58] because of the constraints of real-world transactional contexts where there is a limited time window to complete a transaction. Furthermore, such a measure would exclude those without access to smartphones including a large percentage of people with visual impairments who are low-income, for whom cash is the only means of payment [1]. The efforts by the state here are in contrast to countries in Europe, where currency notes and coins are accessible to people with visual impairments[3].

Likewise, the accessibility of apps and technology is also shaped by accessibility standards and compliance measures (for instance WCAG [33]) which in the Global North are often enforced by state legislation (for instance, ADA in the USA [2]). However, in India - the National Policy on Universal Electronic Accessibility [5] only holds state-owned ICTs accountable to compliance

[2]https://www.fastcompany.com/90306499/delivery-workers-tip-us-in-cash-so-companies-have-to-pay-us-more.

measures and not private players which partly explains why Uber (and Paytm), an international app that conforms to standards in the USA was more accessible than Ola (and Ola Money) which was inaccessible. Thus, here too, we see that there is little help from the state in promoting inclusion. Finally, it is worth noting that the challenges we describe with regard to payments are unique to people with visual impairments, as disability is relational, and disabling social barriers are, in fact, shaped by the nature of one's impairment [71]. For instance, people with motor disabilities, might be disabled by the lack of ramp access to ATM machines, which people with visual impairments are not necessarily constrained by, but are disabled by the limited accessibility of the machines themselves (for instance, by the lack of tactile keys). However, the response of the state and their lack of effort in implementing accessible financial infrastructures is reflective of the larger attitudes towards people with disabilities in the country, who continue to be excluded and marginalized.

6.4 Design Implications

Our study reveals that cash, whilst central to everyday transactions, is inaccessible to people with visual impairments and making them accessible would require considerable change in infrastructures. However, improving the accessibility of digital payments - both in the ride-hailing context and elsewhere - is more feasible and, here, we reflect on three potential solutions - improved screen-reader access, two-factor authentication alternatives, and Unified Payment Interface (UPI). We also briefly discuss how technologies could augment cash practices.

6.4.1 Improved screen-reader access. Our participants noted how the the Ola app (and Ola Money) was inaccessible as it had several unlabelled buttons, which are not picked up by the screen reader making it impossible for them to determine their function. Given that many apps in India don't adhere to accessibility compliance measures like WCAG, labeling buttons would be one of the first steps to improve the overall accessibility of mainstream applications including digital wallets like Ola Money.

6.4.2 Two-factor alternatives. Two-factor authentication is intended to provide an extra layer of security for digital transactions. In addition to a PIN/password/CVV, in the Indian context, the user receives an OTP on the mobile number linked to their bank account, which they have to confirm to process a transaction. As we elucidate, this necessitates extra work for people with visual impairments. Although OTPs make transactions more secure, our case illustrates that it can, at the same time, make it more inaccessible for people with visual impairments, thereby creating a security-accessibility trade-off. Whilst one solution could be to embed OTP readers into apps (such as Uber) which could automatically retrieve the OTP from the SMS received, and process it for authentication, this design still entails a trade-off between accessibility and user privacy/security - an important consideration given the concerns people with visual impairments have with online transactions [9, 10, 35, 74]. One way to address this accessibility-security trade-off and simultaneously work for people with visual impairments would be a fingerprint-based biometric authentication. This mechanism would eliminate the need to wait for OTPs and the issues with listening and typing them carefully i.e. 'situational impairments' [39, 77, 78]. Another alternative would be contactless cards[3], which are witnessing increased adoption in the Global North. Contactless cards afford only micro-transactions for security purposes and eliminate the need for authentication as its users only have to wave or flash the card at the point of service (PoS) terminal to complete a transaction. Whilst people with visual impairments might still need assistance in locating the machine, for transactions that occur regularly but are not of a high value, they can be useful in terms of reducing the work associated with card based authentication.

[3]https://www.creditcards.com/credit-card-news/contactless-tap-and-go-cards-us-market.php

6.4.3 Unified Payment Interface (UPI). Unified Payment Interface (UPI) - an interoperable, payment infrastructure that enables users to link their bank accounts directly to a mobile application[4] - launched by the Indian Government - could reduce some of the work associated with cards/wallets for people with visual impairments and simultaneously foster better collaborations like, for instance, between them and the driver. UPI can potentially be a win-win for both riders and drivers in the ride-hailing context (and potentially other transactional contexts) for four important reasons. First, by offering a static-PIN based authentication, it helps people with visual impairment overcome the problems with OTPs by doing away with them altogether. Second, it potentially allows the customer and driver to bypass the platform in the payment process. For instance, the rider can choose "cash" as the payment method at the time of booking and still pay by UPI, provided the driver has a UPI ID. The driver receives a payment confirmation once the transaction is complete. Gig workers have indicated that bypassing the platform is one of the key factors shaping cash preference in the platform economy across contexts[5]. Thirdly, for many of our participants, recharging their mobile wallets entailed work and was hard to accomplish on-the-go. UPI offers a better alternative as it eliminates the need to ensure a minimum balance to initiate rides as the amount is directly debited from one's bank account, facilitated by the app. Finally, UPI levies zero processing/transaction fees, unlike wallets and cards, and, like cash, will settle at par. Although the benefits of UPI are not specific to people with visual impairments, the impact is likely to be magnified because of its ease-of-use and 'accessible' authentication methods which arguably help balance the trade-off between accessibility and security.

6.4.4 Technologies to augment cash practices. Although digital payments are on the rise, India, like most countries in the Global South, is still a cash-driven economy [68]. It is, therefore, important to also think about technology augmenting cash practices that go beyond money scanner applications [44, 58]. As we noted earlier, in transactional contexts, they were nearly impossible for people with visual impairments to use. Earlier, we saw how the estimated price feature helped some participants organize cash and prepare for their forthcoming rides. This feature could be useful in other transactional contexts, especially where one has to place a service/goods order in advance to be picked up or delivered at a later time (say, with groceries or restaurants).

7 LIMITATIONS AND FUTURE WORK

There are some limitations to our study. First, our sample of participants consisted of middle/upper-middle class and educated individuals from metropolitan India. This likely explains why they had access to digital payments in the first place. This sample is not reflective of the larger population of people with visual impairments in the country, a majority of whom are low-income with very little formal education [1]. Second, we had a limited number of women (n=6) participate in our study. Although we tried to recruit more women as part of [38], we found it difficult, probably because the primary researcher leading the recruiting efforts was male. Consequently, the small sample did not allow us to establish a relationship between gender and payments. However, given that prior work has established gender differences in financial practices [25], understanding this perspective is an arena for future work. Finally, our analysis of payments primarily stems from the context of ride-hailing. This allowed us to compare different payment modes in a common transactional context and to establish the role of platforms in mediating relationships between the customer (rider) and service providers/worker (driver) in a gig economy context. However, an analysis of other transactional contexts (like online purchases, groceries, restaurants and so on) is absolutely essential because the affordances of digital payments are likely to be different in these contexts.

[4]https://www.npci.org.in/product-overview/upi-product-overview
[5]https://www.fastcompany.com/90306499/delivery-workers-tip-us-in-cash-so-companies-have-to-pay-us-more

Moreover, it is important to understand situations in which people with visual impairments have to negotiate other non-service relationships. Furthermore, as we show, the affordances of payments vary with transactional contexts which, in turn, dictate the extent of their accessibility (for instance - Paytm, whilst accessible in the case of Uber, was not accessible as a standalone app where the user is required to scan a QR code). This is further complicated by different environmental conditions inducing 'situational impairments' [39, 77, 78]. Thus, improving the accessibility of digital payments in particular necessitates moving out of examining its use in controlled environments and singular contexts to studying its situated use and practices across contexts - which too is a direction for future research.

8 CONCLUSION

In this paper, we presented a qualitative inquiry into the use of cash and digital payments by people with visual impairments in metropolitan India in the ride-hailing context. We found that both cash and digital payments are inaccessible to people with visual impairments and used the "moneywork" framework [63] to highlight the extensive interactional and non-interactional work ('added' work) done by them to overcome the inaccessibility in the pre-,at- and post-transactional phases. We discussed the role of platforms in mediating collaborations between the customer-service provider in relation to payments, and situated the problem of payment accessibility within the broader situations of people with visual impairments in India. We concluded by providing design recommendations to improve the accessibility of digital payments – a critical concern as we seek to ensure that people with disabilities can participate fully in economic transactions.

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