

Towards Conversational E-Government

An Experts' Perspective on Requirements and Opportunities of Voice-based Citizen Services

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Abstract. While chatbots are an increasingly applied new channel for government services, voice-based citizen services and corresponding scientific knowledge on their requirements and design are still scarce. In order to pave the way for prospective conversational e-government services for voice assistants, we conducted five semi-structured expert interviews with government representatives experienced with e-government issues as well as engineering and design experts familiar with voice interfaces. We analyzed their responses on relevant topics such as accessibility, authentication, data protection and open government data and APIs, as well as collected their rich application ideas for a first generation of voice-based citizen services. Based on these results, we derived a set of implications and considerations for both providing the fundamentals as well as designing and implementing conversational e-government services.

Keywords: Conversational interface · Conversational government · Chatbot · Voice assistant.

1 Introduction

In the last few years, so-called *conversational interfaces* have reached the mass-market. They enable users to interact with their smartphones and other ubiquitous devices such as connected loudspeakers in a natural way to obtain information, access Web services, and issue commands (cf. [11]). They appear in form of chatbots (chatting robot) supporting written requests and voice assistants understanding voice commands, both utilizing the potential of artificial intelligence. Accordingly, conversational interfaces provide intuitive natural language-based human-computer interfaces. Although the technology and respective applications are still in their infancy, there are numerous applications being implemented, especially in the business world, where the term “conversational commerce” already was coined [17]. For example, users can apply chatbots to book and check in for flights or to get product recommendations.

In the case of voice assistants, numerous custom extensions are available for either Amazon’s Alexa or Google Assistant, usable either on dedicated devices

or just regular smartphones. Recently, it was reported that merely in Q3 2019 more than 28 million so-called “smartspeakers” have been sold globally [4].

As conversational interfaces use natural language to interact with applications, it can be hypothesized that interaction barriers will be lowered, with great potential also for citizen services. The Open Government movement aims, among others, at improving engagement of citizens in public sector activities and, thus, to focus on more citizen-centric service offerings. Key issues of Open Government are transparency, participation, collaboration, to generate participatory and collaborative dialogue [18]. Therefore, conversational interfaces for e-government services can be understood as part of corresponding multichannel strategies (see [10, 9]). Only recently, the UK government has launched a voice-based service for Alexa and Google Assistant to make information access easier for citizens [6] – one of the first appearances of publicly available “conversational government” services.

In this paper we focus on voice-based conversational interfaces and aim to identify and to analyze the requirements for designing and implementing useful and user-accepted voice-based citizen services. Following a short summary on existing related findings from literature, we present the results of five semi-structured expert interviews with government representatives experienced with e-government issues as well as engineering and design experts familiar with voice interfaces. Based on the corresponding results, the contribution of this paper includes a first set of implications for enabling voice-based e-government services as well as several ideas for suitable first applications, both from an experts’ perspective.

2 Related Work

Whereas so-called chatbots offering e-government services can be found in practice in the meantime, voice-based services are not yet deployed broadly, if at all. We hardly have scholarly knowledge about experiences or requirements of voice based governmental services, especially from a non-technical perspective. There is some literature available addressing conversational interfaces in the e-government context from the perspective of deploying artificial intelligence (e.g., [2, 12]). Furthermore, technical, design, as well as linguistic challenges have been addressed in prior research (e.g., [1, 3]). Issues such as the citizen’s or public authority’s perspective including multi- or cross-channel or process integration issues or legal/regulatory issues have hardly been addressed so far. In a comprehensive literature study, Madsen and Hofmann investigated the literature of multichannel management in the public sector [9], but aspects of requirements for any channel have not been subject to any of the identified papers at all.

As one of a few papers Lindgren and Jansson [8] take a more broad, interdisciplinary perspective and propose a conceptual framework for public e-services. Three dimensions of public e-services have been defined, which are “Public”, “e-”, and “Services”. Several characteristics for each of the dimensions have been identified; they could be interpreted as success factors or requirements for re-

spective services. These are, among others: need to ensure comprehensive legal framework with different degrees of discretion (dimension public), a technical artifact, constituted of Internet-based technology, some degree of interaction, connections to other information systems, e.g., back-office systems (e-dimension), or service as a process must be perceived as a process in which value is co-created by consumer and supplier (services dimension). Hence, studying the dimensions including their identified characteristics and adopting them might be a starting point to derive more concrete requirements for conversational e-government services.

Beyond the public sector, conversational interfaces are being used more widely in the business domain where the term “conversational commerce” has been established already. But although there are several systems implemented facilitating consumers’ interaction with suppliers, e.g., such as product search or flight check in, there is not a rich body of research literature available either. In a rather recent study, the authors present an exploratory study on customers’ perception of conversational commerce [17]. Applying a broad perspective, the study reveals opportunities, challenges, as well as process implications of conversational commerce and provides a comprehensive framework. Therefore, also the knowledge about conversational commerce might provide a further starting point for developing criteria for a successful development of conversational government services.

In summary, there is hardly any scholarly literature available addressing voice-based citizen services, their requirements beyond technical aspects nor challenges and opportunities. Issues such as the citizen’s or government authority’s perspective including cross- or multi-channel or process integrations or legal/regulatory issues are missing in the literature so far.

3 Method

To learn more about potential requirements, challenges and opportunities of voice-based citizen services, we conducted a set of expert interviews in Switzerland. We deliberately focused this early investigation on government representatives with knowledge on (e-)government services and processes as well as senior staff of technology companies experienced in realizing voice interfaces and services. We outline our plans for studying and integrating requirements from a citizen perspective in the final section of this work.

Table 1 gives an overview about the interviewed participants: P1, P2, and P3 were government representatives on different governmental levels (city, province, state), each one with several years of experience in public service and responsible for e-government matters. P4 and P5 were experts with engineering and design backgrounds. Both have been holding leading positions in several projects involving voice interfaces.

Each interview with the participants was conducted by two researchers. They kicked-off the conversation with a short introduction on the recent state-of-the-art of voice assistants and asked for the interviewee’s knowledge level to consider

it during the interview. The actual interviews were semi-structured following a guideline with central questions. These addressed opportunities for facilitating access to e-government services as well as requirements and challenges, e.g. from a technical, legal, or organizational perspective. Furthermore, we asked them for potential application fields and concrete ideas for voice-based citizen services.

The interviews took between 60 and 90 minutes and were conducted between April and June 2019. Both researchers took notes on the interviewees' comments. Additionally, the interviews were audio-recorded on a smartphone for later analysis. During post-study analysis, we identified common themes in the interviewees' responses and clustered related statements into requirement groups.

Table 1. Participants of the expert interviews.

Id	Job	Institution
P1	Chief Digital Officer	City Government
P2	Group leader service development	Federal Chancellery
P3	Head E-Government	Province Government
P4	Software Project manager	Digital Agency
P5	Innovation Manager	Software Company

4 Results

In the following, we report on the results of the expert interviews. First, we report on collected requirements of voice-based government services, then we outline application ideas generated by the participants.

4.1 Requirements

This section summarizes and groups participants' statements regarding overall requirements.

Design of (Governmental) Voice Interfaces. The interviewees with experience in implementing voice-based services, P4 and P5, advised to consider humans' cognitive limitations when designing a voice interface. Both emphasized the importance of short, precise answers of a respective voice assistant for governmental purposes. P4 mentioned a certain fatigue of users of voice assistants, when dialogues are lengthy and require more than three consequent user requests.

P5 recommended designing a voice assistance service for integration in a user's routines. An example is a weather forecast for the day, often used in the morning during having breakfast. He noted that many governmental services, in

contrast, address non-routine, irregular tasks. For example, reporting a change of residence to the local registration office is a relatively rare event. Several simpler tasks such as accessing information on governmental services (e.g., opening hours of a governmental office) can be solved by popular voice assistants without any custom extension, since this information is available on the authorities' official Web pages and can be found through a Web search.

P3 emphasized that a voice assistant for governmental services should provide functionality beyond information access. As examples he mentioned pro-active notifications by a respective assistant, such as suitable context-aware reminders for dates of the carbage collection. Additionally, he considered hedonistic aspects very important: "Such a voice assistant must provide added value for the citizens, yet, at the same time, should be fun to use."

Accessibility. Based on experiences from prior e-government projects, P4 mentioned an important requirement of respective digital citizen services: Accessibility. In contrast to other applications, such services must be usable by as many user groups as possible to not exclude citizen minorities.

Authentication. The need for an authentication of the user became evident for several advanced e-government services involving privacy-critical information. P5 elaborated on recent technical possibilities to realize user authentication for voice-based services: One factor authentication methods include speaker recognition (solely relying on voice characteristics) as well as a password-style method involving a private pin. For example, purchases via Amazon Alexa can be confirmed by saying a self-defined four-digit pin code.

Alternative two-factor authentication techniques make use of the user's personal device. When an authentication is required, the voice assistant notifies the user's smartphone. Using a typical push notification, a custom authentication app then shows a respective prompt for the user to confirm the authentication request. This may either be realized by a push notification or, according to P5, by audible or non-audible sound signals sent by the voice assistant and detected by the smartphone app to ensure the physical proximity of the device (and its owner, respectively).

P1 related to the authentication mechanism implemented in a chatbot for governmental services. Therein, a user may identify herself using her personal tax reference number. P1 considered this solution sufficient for several governmental services, since "the potential for abuse is very limited". He notes, that several additional security measures can be implemented which do not make authentication harder for the user. For example, ordering official documents such as a tax report may only be allowed once per month. In addition, "automated misuse of these services must be prevented", P1 emphasized.

P2 confirmed this approach and claims "a simple, low-threshold solution for the user" too. Potential errors should be rather corrected later by withdrawal, for example.

As authentication proves the real identity of a user, here the citizen, the described technologies can be used as well for a weaker identification. Here, a certain identity can be proofed which not necessarily has to be the true identity of the citizen.

User-Perceived Security. Furthermore, P2 argued for a user-centered investigation of security measures for voice-based citizen services. Since there are currently no such services offered in Switzerland, there is no validated knowledge on how strong respective identification and security measures need and are expected to be. “Maybe citizens do not consider their government data that sensible?”, he added.

P5 mentioned a related user-oriented security aspect of future voice-based services: “How can a voice assistant communicate that its user is authenticated, or a secure connection has been established?” The acceptance of advanced voice-based services may depend on the citizen’s trust in a respective voice assistant, he added.

P1 reported on related requirements regarding a recently launched chatbot offering governmental services. To protect personal data, user sessions are reset after 30 minutes. All entered data are then cleared and the user informed, respectively. He concluded that also a voice assistant must provide such functionality and clearly communicate its behavior.

Processing Privacy-Relevant Information. The handling and protection of privacy-relevant information was a central topic in several interviews. After having detected a wake-up word (“Ok, Google!”, e.g.) locally, today’ popular voice assistants such as Alexa and Google Assistant send the users’ utterances to remote data centers for analyzing and understanding the content. For example, P2 considered data protection “a major challenge”.

While P5 noted that Google and Microsoft are about to build local data centers (especially for cloud-provided office software), P4 emphasized that these companies do not guarantee any specific location for processing collected voice data. He further noted that users need to consent that their voice data can be used for training purposes before they are able to use Alexa, for example. In a similar vein, users of a conversational government service on a mass-market voice assistant must be made aware again, that their voice data may be analyzed in global data centers and be used for other purposes – out of scope of the authority providing the service. P5 mentioned the availability of alternative voice assistants that can be installed on own hardware and process data only locally. Yet, he considered such assistants currently not suitable to reach citizens on a large scale.

Robustness of Speech Recognition. To ensure best recognition rates and successful voice-based services, P4 recommended implementing highly structured use cases. He mentioned the example of a mobile app for national public transport: When planning a route, the starting point and destination can be spoken,

instead of clumsily typed in. Due to the limited vocabulary, the stops can even be spoken in vernacular language (due to a tailored speech recognition engine).

While talking about the quality of today’s speech recognition, we asked the interviewees on how important they estimated the support of vernacular language for the acceptance of voice-based citizen services. While P4 considered understanding vernacular language as a crucial requirement for the citizens’ acceptance, the remaining interviewees held another opinion. P5 attributed a minor relevance, since “speaking standard language can be expected for bank and governmental services”. He added, that, based on his experience with voice services, “about 70% of vernacular utterances are correctly recognized by the big players”, anyway. P1 and P3 agreed that, in a first step, offering conversational services supporting vernacular language is not relevant. P1 emphasized that not vernacular but standard language is the administrative language. Additionally, P4 pointed out, that e-government services in many cases might involve several special terms, mass-market voice assistants might have trouble understanding. As consequence, respective services should be designed to not rely on the recognition of such rare terms.

Governmental Processes and Culture. All interviewees agreed that the digitalization of governmental processes poses special requirements. P4 mentioned the complexity of several core processes, partly resulting from rigid authority structures having evolved over long periods of time. Based on own experiences, P4 recommended reconsidering a governmental process before offering a related voice-based service.

P2 noted that advanced digital citizen services such as voice-based services provide a major paradigm shift for governments and their processes: Instead of citizens visiting a governmental office, sophisticated digital services approach the citizens.

P3 also addressed the governmental culture and mentioned potential reservations of civil servants. Especially the topic of “big data” and publishing governmental data sets in form of “open government data” are seen critical due to data protection concerns, according to P3.

Technical Implementation and Integration. Regarding the technical implementation of voice-based citizen services, P3 held the view that governments should not take the lead. Instead, third parties should be motivated to create respective citizen-oriented services based on open government data.

To realize more sophisticated interactive services beyond information access and to initiate governmental processes through third party applications, respective APIs (Application Programming Interface) are required. However, such “Open Government APIs” (in analogy to recently emerging Open Banking APIs, e.g.) are still a vision. None of the authorities of the interviewed governmental employees P1, P2, and P3 currently offers such publicly accessible service interfaces.

4.2 Application Ideas

During our interviews, the participants generated various ideas for voice-based governmental services. In the following, we shortly outline application ideas mentioned by several interviewees including some thoughts regarding their implementation.

Requesting Official Documents. From time to time citizens need to provide official documents such as a statement from the debt collection register, criminal records, parking permit, or residence certificates to apply for a visa or a job, e.g. Requesting such a document could be implemented through a rather simple dialogue. But as most of the documents contain very personal information the core requirement is an authentication of the user as a precondition to provide the service. Furthermore, it can be assumed that some municipalities will not allow to leave these data the country which has an implication of which voice platforms can be utilized. In addition, these documents are subject to charges which constitute another challenge.

Reporting Damages. Many cities offer Websites and apps to report damages to public infrastructures such as potholes and broken street lights (“Fix my Street”, e.g.), etc., but also to report general complaints or even to collect citizens’ ideas. A low-threshold voice-enabled interface could motivate citizens to report incidences even more. Although an authentication is not needed some kind of identification (maybe optional) would be helpful to prevent false reports but also to enable further communication and follow up with the user, e.g., to ask for more details or to give feedback to the user. A challenge would be the issue of exact localization of the incident to be reported. Whereas voice-enabled services used on smartphones may make use of the device’s localization capabilities, using a smart speaker, which is located usually at home, would need some further functionalities to capture the location of a reported damage, in case it is needed.

Information retrieval and calculator. Another area of potential applications could be the retrieval of information and, in addition, a calculator. Relevant information for citizens is any information offered by a community which is relevant to citizens, e.g., tax related information, responsibilities for certain issues within an administration, poll and election related information, etc. A further area of application to think about could be to use voice-enabled services to access open government data repositories.

In case a citizen wants to or has to determine whether he or she is eligible for a certain service, such as reduction of health insurance rates, a calculator could be offered. Such a calculator, known from related Websites, could guide a user through the application and ask for the respective information and finally present the result to the user via voice output.

Similar services have been implemented as a chatbot already. Authentication or identification might not be needed for these kinds of services, nevertheless, it might be helpful to store data and/or results to follow up on a case online or in direct interaction with people from administration which would require some kind of identification or even authentication. A challenge might be the limitations of speech recognition as users articulate their concerns in many different forms of verbalization.

Reminders. One possible field of application identified is a city’s calendar for garbage and waste paper collection. In this specific case of a city, the collection plan has a certain structure and is defined per year but contains irregularities because of holidays and other circumstances. Thus, citizens need to consult a source of information to find out the respective date. Today, this is solved via paper-based information sheets as well through an online e-government application which is also available as a mobile app. As these data are (rather) static and publicly available anyway and as there is no need for integrating the process into existing administration applications and also further functionalities such as authentication or payment is not necessary, but on the other hand this information are needed by citizens throughout the year, this case is a candidate for first conversational e-government service. Related generic reminder applications are available for Amazon’s Alexa assistant, e.g., yet require the user to import calendar data assuming certain technical skills.

Relocation Assistant. In case citizens plan to relocate within or between cities, several public services have to be involved. For citizens it may be a challenge to identify all services and to contact them in time. Therefore, a relocation assistant could guide a citizen through the relocation process. The service not only could provide necessary information about what, when, and who, but also could remind people of tasks and deadlines. Of course, this service is rather complex and needs several functionalities already discussed, such as authentication of the citizen, in case the service should support issues such as registering a change of address, payment, full integration into administration’s services, and others. Furthermore, it has to be defined as one channel of a multi-channel strategy; here, the voice assisted service can be understood as a further touchpoint to support the citizen along the so-called citizen journey [14]. This kind of voice-supported assistant could also be applicable to other domains of governmental services, e.g., in the areas of unemployment benefits or building applications.

5 Discussion and Implications

In our discussion, we derive implications for paving the way for and designing and implementing voice-based citizen services.

Providing Government Data and APIs. All three involved government representatives expected to see the development of voice-based citizen services by third parties, not by public institutions. Given the required special skills and the efforts for providing respective services for several different voice platforms, such an open innovation approach seems reasonable. Lots of municipalities started Open Data initiatives and published remarkable amounts of data sets (mainly resulting in mobile apps). Open Government Data also provide the base for prospective voice-based citizen services facilitating information access (cf. [15]). However, to enable the development of advanced interactive services, third parties need to be allowed triggering and initiating government processes. Corresponding Open Government APIs seem a crucial building block to boost the creation of more future powerful voice-based citizen services.

Selecting Suitable Citizen Services. The design of convenient user-accepted voice interfaces involves several challenges (cf. [7]). Since audio feedback is non-persistent and it is harder to communicate the state of a current process than in a graphical user interface, the length of a conversation with a voice assistant should be limited. Regarding the use case, voice-based services work well when they can be integrated into people’s daily routines (typically while performing another primary activity). Many government services seem to have an opposite character. E.g., filling in a complex tax form is time-consuming, needs the person’s entire attention and is done rarely (and in long periods).

We conclude that, first, citizen services for voice assistants need to be carefully selected regarding their complexity and periodical usage to provide true sustainable value. Second, several government services might need to be rethought on the path to truly citizen-oriented e-government services. Similar as traditional government processes were optimized for today’s e-government Web portals, a related step seems necessary for offering advanced complex government services via voice assistants.

Ensuring Accessibility. While voice-based services provide great potential for blind people, government services provided via a voice assistant obviously exclude deaf and dumb citizens. In order to ensure overall accessibility, voice-based citizen services should not cover fundamental or critical government processes or rather complete alternative channels such as a Web platform.

Convenience over Strong Authentication. Advanced personalized citizen services will require authenticating the current user, obviously. Providing a simple, yet strong authentication for shared voice assistants is still a challenge. Recent approaches (e.g. [5]) rely on multi-factor authentication involving a mobile device. However, the requirement of installing an additional custom authentication app on the smartphone may hamper the acceptance of respective voice-based services. The government representatives agreed that there might not be the need for technically strong authentication, since either the consequences of

a misuse are limited or government processes provide corrective means, such as the later withdrawal of an illegitimately obtained document, for example. They all recommended to focus on the convenience and good usability of respective services during design.

Considering Privacy-Relevant Data. Currently, it cannot be expected that mass-market voice assistants will ensure a certain location for remotely processing speech samples. Therefore, the respective privacy and data protection regulations cannot be confirmed during the deployment and installation of the actual voice service – what should be considered for citizen services involving privacy-relevant data. While Google announced offline support for their voice assistant only recently [16], the impact on custom extensions is not clear yet.

6 Conclusion and Outlook

In this paper, we investigated requirements and opportunities of voice-based citizen services in order to pave the way for a next generation of digital government services: conversational e-government. We reported on the results of five expert interviews with government representatives experienced with digital citizen services as well as senior staff of technology companies familiar with realizing voice interfaces and services. We found that the foundations to develop and implement voice-based citizen services are still rather undecided in many respects. For example, authentication for conversational e-government as well as the investigation of related privacy concerns require further investigation (extending existing trust models for conversational interfaces, e.g. [13]). Based on the interviewees' responses and assessments, we derived several implications as first requirements and considerations from an expert perspective.

The above presented results have been derived from interviews as well as from literature. Based on the findings, we will pursue future activities: First, the citizen perspective shall be investigated following a mixed methods approach. We plan to study citizens' perception, acceptance, as well as requirements in focus groups and an online survey. Second, prototypes of voice-based citizen services shall be developed to demonstrate possible functionalities, study their acceptance and derive concrete design guidelines for the conversational e-government.

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