



Impact of the digital divide on e-government: Expanding from channel choice to channel usage



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ABSTRACT

Many scholars have studied the digital divide, however, often apart from eGovernment research. Therefore, more interdisciplinary research is required as eGovernment can be both hindered by and contribute to the digital divide. First research steps have already been taken, for instance by using access and socioeconomic status as representations for the digital divide. However, the digital divide discipline has developed rapidly and contemporary research findings indicate that, at least in developed countries, not access and socioeconomic status, but digital skills are important representations of the digital divide. Therefore, in order to explore new explanations in channel choice, we incorporated further developed digital skills measurements into eGovernment research channel choice measurements. Accordingly, this research explores the citizen's perspective by studying actual channel use in the Netherlands.

Results show that, surprisingly, digital skills do neither predict nor relate to choosing the online channel. However, they do predict the degree of satisfaction; the more digitally skilled citizens are, the more satisfied they are with online services. Results also show that the nature of interaction significantly coheres with channel choice: registration correlates with choosing online channels, consultation correlates with choosing offline channels.

These findings bring us to the thesis that when it comes to the uptake of eGovernment, at least in developed countries, digital skills become less relevant. However, they come into play when it concerns the perceived quality, expressed in terms of satisfaction. This could mean that, in the long run, many citizens are going to use eGovernment anyway, no matter how (un)skilled they are, no matter how complex these services are. As such, we see the emergence of a new important research question in the multidisciplinary domain of eGovernment. Namely, what are the implications of channel use for policy implementation? Because if less digitally skilled citizens are using electronic government services anyway, what happens to policy goals that heavily rely on online services?

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1. Introduction

About two decades ago, governmental agencies had a far too positive outlook on the uptake and increasing usage of electronic service channels. Expectations were that the more cost-efficient electronic service channels would replace the more expensive traditional channels, such as the telephone and front desk (Pieterse & Van Dijk, 2007). However, studies from various countries, such as Switzerland (Berger

Fachhochschule & Unisys, 2005), Canada (Erin Research, 2003), the Netherlands (Bongers, Holland, Vermaas, & Vandenberg, 2004), and Australia (Australian Government, 2005) indicate that about ten years ago governmental agencies were still confronted with high numbers of contacts via traditional service channels, i.e. front desk and phone. Further, more recently, we see that citizens in citizen-to-government or entrepreneurs in business-to-government interactions still prefer the telephone or front desk over the website (e.g., Kræmmergaard & Østergaard Madsen, 2015; Reddick & Anthopoulos, 2014; Reddick & Turner, 2012; Van den Boer, 2014). These differences between expectations and reality uncover a gap in preferences both parties have for service channel management (Ebbers, Pieterse, & Noordman, 2008). As a result, Ebbers et al. (2008) proposed an alternative multi-channel management strategy (MCM) including a channel-type-channel-mode model that takes both the citizen's and the government's perspective

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into account. They subsequently argue that the multi-channel strategies of governments are better based upon task-channel elaboration, as different channels support different tasks. Recently, a study on citizens' channel choice showed that when online applications were mandatory, voice phone-calls were preferred for problem solving related to those mandatory online applications (Kræmmergaard & Østergaard Madsen, 2015). Other scholars found that the Internet is primarily used for information collection and advice retrieval, while office visits are most often used for applications/registrations, and the phone is the main channel to solve individual problems (Reddick & Anthopoulos, 2014). As such, these studies indicate that the task based nature of the interaction is an important determinant in channel choice.

A relatively new perspective that might help explaining channel choice is that of the digital divide (Van Deursen, van Dijk, & Ebbers, 2006). Since research within this perspective is often conducted apart from eGovernment research (Helbig, Gil-García, & Ferro, 2009), catching up is required as eGovernment and digital divide research are intrinsically intertwined as eGovernment policies can be both impeding by and exacerbate the digital divide (Belanger & Carter, 2009). First research steps have already been taken, for instance by studying channel choice using access and socioeconomic status as representations for the digital divide (Reddick, 2005; Reddick, Abdelsalam, & Elkadi, 2012; Reddick & Anthopoulos, 2014). While early research on the digital divide focused mainly on a binary classification of physical access, more recent conceptualizations have revealed that one of the factors that appears to be most important is the differential possession of digital skills (Van Deursen & Van Dijk, 2011). The goal of this current paper is twofold. The first goal is to summarize the state-of-the-art in eGovernment research from two perspectives that we believe to be important to explain channel choice: the impact of nature of the interaction on channel choice on the one hand and of digital skills on channel choice on the other hand. The second goal is to empirically test a combination of both perspectives, by testing three guiding hypotheses based on both perspectives.

2. The role of nature of the interaction and digital skills in channel choice

Pieterse (2009) conducted a very comprehensive study on channel choice. His findings suggest that citizens choose channels that suit their task and its given characteristics best, a so-called task-channel elaboration. The elaboration process depends on (1) complexity and ambiguity of the task on and on (2) the richness characteristics of the channel. This is in line with the earlier proposed multichannel strategy of Ebbers et al. (2008), which was based on three contingency principles. First, front desk and phone are the preferred channels for removing problem ambiguity, whereas the Internet and front desk are the preferred channels for handling problem complexity. Second, complex problems are handled via the consultation mode and ambiguous problems are handled via the conversation mode. Third, the conversation mode is best facilitated by the front desk or phone and the consultation mode is best facilitated by website and front desk.

A recent literature study on channel choice (Østergaard Madsen & Kræmmergaard, 2015) indicates that much research on channel choice is rooted within the perspective of 'the nature of the interaction', trying to explain channel choice using channel characteristics and task characteristics as important variables. Therefore, we choose 'nature of the interaction' as our first perspective to explain channel choice, though we are aware of other perspectives, such as related to 'trust' (Reddick & Anthopoulos, 2014). Recently, Kræmmergaard and Østergaard Madsen (2015) studied how citizens in Denmark can be guided towards online services. Their findings show that when the online channel is mandatory, for performing transactions, the phone is the primary channel for solving problems that arise with these transactions. Findings indicate that the nature of the interaction and the nature of service related tasks are important factors in citizens' channel choice. Furthermore, Reddick and Anthopoulos (2014) conducted a channel choice study in

Canada. Their results show that, notwithstanding the fact that the use of traditional channels is decreasing (traditional office visits decreased from 64% in 2005 to 47% in 2012), website usage increased to 47% in 2008, and then declined to 38% in 2012. Reddick and Anthopoulos (2014) associate this decline with the limited problem-solving capabilities of websites. Moreover, their data illustrate the differences in what different channels are used for: the front desk is most often visited for applications/registrations (62%), voice phone-calls are predominantly used for problem solving (68%), and government websites were mostly used for information or advice retrieval (53%) (Reddick & Anthopoulos, 2014). They found four factors to be key predictors of channel use: (1) user satisfaction with the channel, (2) nature of the transaction, (3) security/privacy and last but not least, (4) the digital divide. This latter factor will next be discussed.

The digital divide, or 'digital inequality', can be conceptualized in different ways (Van Dijk, 2005). In general, scholars (e.g., Belanger & Carter, 2009; Van Deursen & Van Dijk, 2011; Van Dijk & Hacker, 2003) distinguish between two groupings or levels in the digital divide: an access divide (or inequality between those who have access to technologies and those who have not, e.g. 'the haves' and 'have nots') and a skills and usage divide (or inequality in the ability to use the technologies). In developing countries particularly, the first level of the digital divide still represents a barrier for advancing eGovernment implications (Martin, 2005; Reddick et al., 2012). However, in developed countries, the effects of the access divide are diminishing, as a result of general growth in internet access. But, though many citizens have access to the Internet, this does not automatically mean a high uptake of eGovernment use, since there is a gap between actual and potential usage of eGovernment (Van Deursen et al., 2006). These findings indicate that instead of an access divide, a skills divide is much more relevant. Indeed, merely being able to materially or physically access the Internet to make use of eGovernment services is no longer a sufficient representation of the digital divide in developed countries: it is much more important to what extent differences are present across skills (Belanger & Carter, 2009; van Deursen et al., 2006; Van Deursen & Van Dijk, 2011; Van Dijk, 2005). According to Belanger and Carter (2009) skills are an important determinant in the take-up of eGovernment, as "one's ability to effectively use the Internet ... has a significant impact on intentions to use eGovernment" (Belanger & Carter, 2009, p. 134).

3. Theoretical framework

The line of reasoning mentioned in former section produces two more or less diverting points of view. The first is that the nature of the interaction or tasks strongly coheres with what channels are chosen by citizens. More specifically, the electronic channel is preferred to perform registrations or transactions and offline channels, such as telephone and front desk, are preferred to consult. The second point of view is that the more digitally skilled citizens get, the more they intend to use eGovernment services. Following these mindsets, we are especially interested in further exploration of possible explanations in channel choice combined with studying the impact of a divide in digital skills. In this explorative stage of these diverting mindsets, we think it is still too early to develop and test a comprehensive research model. Therefore, our overall guiding explorative research question is:

What are the roles of 'nature of the interaction' and 'digital skills' in channel choice?

As mentioned earlier on, the first point of view implies that the nature of interaction strongly coheres with channel choice: the electronic channel is preferred to perform registrations or transactions and offline channels are preferred to consult. This brings us to the following hypotheses:

H1. The nature of the interaction correlates with citizens' channel choice.

We specify this hypothesis with the following two sub hypotheses:

H1A. Citizens predominantly use online channels to conduct registrations and transactions.

H1B. Citizens predominantly use offline channels to consult with government.

The second point of view suggests that the more digitally skilled citizens get, the more they intend to use eGovernment services. Especially this second point of view is rooted in Belanger and Carter's (2009) intentional instead of actual eGovernment use. To take research on the impact of the digital divide on eGovernment a step further, we will focus on actual use instead of intentional use. Furthermore, we expect that the more digitally skilled citizens are, the more they use eGovernment for registration and transaction. Derived from Belanger's and Carter's (2009) findings on intention, and combined with Reddick and Anthopoulos (2014) that satisfaction predicts eGovernment use, we also expect digitally skilled citizens to give higher value or estimations to eGovernment services. This brings us to the following hypotheses:

H2. The more digitally skilled citizens are, the more they use eGovernment services.

H3. The more digitally skilled citizens are, the higher their satisfaction of the eGovernment services offered.

Below, divided into three parts, we discuss the main determinants of nature of the interaction related channel choice and of digital skills as used in the current study. The first and second part relate to the overall research question and directly related hypotheses: What is the influence of 'nature of the interaction' and 'digital skills' on channel choice? The third part covers the second and third hypothesis and relates to satisfaction but also to some social demographics as possible determinants. As for the latter: although, in line with our overall and explorative guiding research question, we focus on digital skills' and 'nature of the interaction', we feel it is necessary to take personal characteristics into account too. As many studies have shown that the basic personal characteristics, such as age, education and gender are predictors of channel choice (Ebbers & Van Dijk, 2007; Pieterse & Van Dijk, 2007; Reddick, 2005).

3.1. Interaction related channel choice

The nature of an interaction relates to task complexity. As mentioned earlier on, task complexity relates to the amount of information that needs to be transferred regarding a certain task. Furthermore, task complexity relates to the subjective uncertainty about task inputs, process, and outcomes (Byström & Järvelin, 1995; Ebbers & Van Dijk, 2007; Van de Ven & Ferry, 1980). Several studies show that task complexity influences channel choice (Black, Lockett, Ennew, Winklhofer, & McKechnie, 2002; Lee, 2002). More specifically, in case a task is complex, citizens favor the phone or counter in order to initiate contact with a governmental organization (Pieterse, 2009; Pieterse & Ebbers, 2008; Reddick, 2005), whilst when a task is simple, citizens are more likely to use the online channel (Pieterse, 2009). Earlier research findings suggest that the nature of the interaction is related to channel choice (Pieterse & van Dijk, 2007; Reddick, 2005; Reddick & Turner, 2012; Van der Geest, 2014). If citizens just need information, they are inclined to use the website, whereas citizens who want to solve a problem are more likely to use the phone or visit the counter (Reddick, 2010). These findings suggest that different types of interactions exist. Based on Ebbers, Pieterse and Noorman (2008), we can differentiate between five types of interaction, also called 'modes'. First of all, 'consultation' is a mode wherein a user connects to an information source of an organization to find the requested data. Although the organization provides the information, the user has to select and obtain the demanded

information himself and therefore no real interaction occurs. Second, 'registration' refers to a mode wherein a citizen sends information to an organization. An example is returning a filled tax form; this form contains taxpayer's information that is required and registered by the tax administration. This can be considered as a two-sided interaction mode, because a taxpayer sends information that is asked for. Furthermore, a financial type of interaction, or an exchange where financial matters play a part, is called 'transaction'. The fourth mode is conversation, wherein a user wants information and the organization furnishes the requested information, tailored to the user's needs. An example of this mode is a citizen who calls his public employment agency with a question and gets a response to his question. The final mode is called 'allocation', wherein an organization sends information to users, for instance in a TV commercial. However, allocation is a single-sided interaction mode initiated by organizations. As we are interested in the citizen's perspective or at least in two-sided communication, this mode is not relevant to our research.

The current study distinguishes between the following types of interaction: registration, consultation, and transaction as variables. Initially, we also took conversation into account. However, conversation is a mode that covers participation or policy related interaction while our study focusses on eGovernment services and the service provisioning of government organizations. Subsequently, we introduced 'status' as an alternative for the conversation mode and the two-sided interaction that this mode renders, as will be explained in the method section.

3.2. Digital divide: digital skills

Belanger and Carter (2009) operationalized 'skills' in terms of experience with several different activities on the Internet, such as the extent to which someone uses the Internet for online purchases. They found that internet usage and online information search experience are significant predictors of the intention to use the Internet. Although interesting and meaningful insights were provided, performing certain activities does not automatically mean people are skilled in these activities, or overall (Van Deursen & Van Dijk, 2011). Recently, Van Deursen, Helsper, and Eynon (2016) conceptualized, operationalized, and validated an Internet skills framework consisting of: *Operational skills* are the basic technical skills required to use the Internet. *Mobile skills* are the basic skills to use mobile technology to go online. *Information navigation skills* relate to searching your way around information, including the ability to find, select, and evaluate sources of information on the Internet. *Social skills* encompass the ability to use online communication and interactions to understand and exchange meaning, entailing searching, selecting, evaluating, and acting upon contacts online, attracting attention online, profiling, and the social ability to pool knowledge and exchange meaning. *Creative skills* are the skills needed to create content of acceptable quality to be published or shared with others on the Internet. For the purpose of the current study, we focus on information navigation and mobile Internet skills.

3.3. Other determinants of channel preferences

A third set of variables that influence channel choice includes the extent to which people prefer the online channel and social demographics. In general, the influence of prior experiences, for instance experiences respondents have with certain channels and how satisfied they are with these channels, is widely acknowledged in media choice research (Carlson & Zmud, 1994, 1999; Reddick & Anthopoulos, 2014). More specifically, Reddick and Anthopoulos (2014) state that online satisfaction predicts eGovernment use. Therefore, we consider (website) satisfaction as an important determinant for our research. Furthermore, basic personal characteristics, such as age, education, and gender are predictors of channel choice (Ebbers & van Dijk, 2007; Pieterse & van Dijk, 2007; Reddick, 2005). People who visit the website tend to be younger, higher educated and male (Pieterse & Ebbers, 2008). Those who like to

contact the government at the front desk tend to be aged 50 years and older, and educated to secondary school level (Ebbers et al., 2008). People who are older tend to use the phone to contact the government (Reddick, 2005). As such, with regard to personal characteristics, this research will include age, gender, and education.

4. Method

4.1. Sample

Data were collected using an online survey. A random sample was drawn from the citizens in the city of The Hague; one of the biggest cities of the Netherlands. A professional marketing research agency conducted the sampling and fieldwork. Participants were recruited via an online panel and received a small monetary reward to participate. Only participants of age 18 years or older were selected. A total of 985 people started the survey, but a selection question ensured only participants who had been in touch with their municipality in the last two years could proceed with the survey. Eventually, a total of 779 respondents completed the survey. Socio-demographic variables of respondents were compared to census data (Central Bureau for Statistics). Comparisons showed that the participants were highly representative for the Dutch population, except for young people (age 18–25) who were slightly underrepresented. Further, low educated people were underrepresented and highly educated people were overrepresented. See Table 1.

4.2. Measures

The first dependent variable is the actual channel choice of citizens during the last time they contacted the local government. Respondents could choose whether they contacted the government via website, phone, front desk, email, post, mobile app, or social media. First, the most common channel for citizens was the government website, through which 38.9% of the respondents communicated with the government during their last contact. The second most used contact channel was the phone, with which 29.9% of the respondents contacted the government. Next, 18.5% of the respondents used the front desk during their most recent contact. Less popular methods of contacting the government were using email (7.7%), post (4.5%), mobile apps (0.3%), or social media (cumulates to 0.2%), as can be seen in Table 2.

The second dependent variable is frequency with which citizens contacted the local government via the website. Respondents could choose whether they contacted the government every day, once a week, two to three times a month, once a month, once a year, or less than once a year. The results are presented in Table 3. The majority indicated to visit the website once a year (54.7%). Next, a substantial

Table 1
Characteristics of participants ($n = 779$).

Characteristic	% of sample ($n = 779$)	% of population ^a
Gender	Male	45.4
	Female	53.5
	No answer	1.1
Age	18–25 years	7.7
	25–35 years	19.6
	35–45 years	17.6
	45–55 years	19.9
	55–65 years	19.9
	65 years or older	14.1
Educational level	No answer	1.2
	Low	18.4
	Medium	40.4
	High	40.0
	No answer	1.1

^a Derived from CBS Statistics Netherlands, 2015 derived from www.cbs.nl at June 19, 2015.

Table 2
Frequencies in channel choice during the last time citizens contacted the local government.

Channel choice	n	Percentage
Website	303	38.9
Phone	233	29.9
Front desk	144	18.5
Email	60	7.7
Post	35	4.5
Mobile apps	3	0.4
Social media	1	0.1
Total	779	100

Table 3
Frequency of website visit ($n = 717$).

Frequency of website visit	Frequency	Percentage
Every day	1	0.1
Once a week	29	4.0
Two to three times a month	52	7.3
Once month	95	13.2
Once a year	392	54.7
Less than once a year	148	20.6

Note. This question was only posed to respondents who visited the website of this local government in the past two years. 62 respondents did not meet this requirement, resulting in a total of 717 respondents (out of 779) who answered the question.

number indicated that they visited the website less than once a year (20.6%), and once a month (13.2%).

The third dependent variable was satisfaction about the website, which was measured with five items, such as 'I find the website easy to use' and 'It took little effort to achieve my goal via the website' ($\alpha = 0.948$), on a 7-point Likert scale, ranging from 'strongly disagree' (1) to 'strongly agree' (7). Table 4 presents reliability, n, means, and standard deviations per item that build the construct 'satisfaction about the website'.

The first independent variable was nature of the interaction, which was measured by asking respondents for what purpose they contacted the local government during their last contact. They could choose between six purposes (see Table 5). After the data collection, these purposes were merged into four types of nature of the interaction: registration, consultation, transaction, and status. We added 'status' as an extra option type of nature of interaction. One could argue that status is a sub variable of consultation. However, in contrast to consultation, 'status' (i.e. informing on progress when something is vague or doubtful and needs proper explanation either by citizens or public servants) is more likely to render a complex and rich two-sided interaction.

Furthermore, two different types of digital skills that were considered appropriate for this study were measured were included as independent variables, namely information navigation skills and mobile skills. The scales as proposed by Van Deursen et al. (2016) were closely followed. Information/navigation skills were measured with 5 items,

Table 4
Reliability, n, means, and standard deviations of the measures of satisfaction about the website.

	Mean	SD
<i>Satisfaction about the website (7-point scale; $\alpha = 0.948$, $n = 717$)</i>		
On the website, I can easily find what I was looking for	4.86	1.269
I find the website easy to use	4.70	1.468
The next time, in a similar situation, I will visit the website of the municipality again	4.86	1.369
I find the website pleasant to use	5.19	1.293
It took little effort to achieve my goal via the website	4.81	1.376
	4.75	1.457

Note. As with frequency of website channel choice, this question was only posed to respondents who visited the website of this local government in the past two years. 62 respondents did not meet this requirement, resulting in a total of 717 respondents (out of 779) who answered the question.

Table 5
Purposes merged into four types of nature of the interaction.

Original item in survey	Nature of the interaction	Percentage	Frequency (n = 779)
I made an appointment	Registration	47.5	370
I made a registration or a request			
I was looking for information			
I wanted to know how I should make a registration or make a request	Consultation	41.5	323
I was informing what the progress was of my request or my report			
I made a payment	Status	5.5	43
I was doing something else	Transaction	3.5	27
	Other	2.1	16

such as ‘sometimes I end up on websites without knowing how I got there’ and ‘I find the way in which many websites are designed confusing’ ($\alpha = 0.835$). Mobile skills were measured with three items, such as ‘I know how to keep track of the costs of mobile app use’ ($\alpha = 0.792$). For both constructs, 5-point Likert scales were used, ranging from ‘Not at all true of me’ (1) to ‘Very true of me’ (5). Table 6 presents reliability, n, means, and standard deviations per item that build the constructs ‘information/navigation skills’ and ‘mobile skills’.

Finally, the socio-demographic variables age, education, and gender were included as predictor variables.

4.3. Data analysis

Several statistical analyses, involving the Chi-square test of independence and logistic regression, are applied to test our hypotheses. Due to the exploratory nature of the research, additional correlations are conducted.

5. Results

5.1. Nature of the interaction and channel choice

The first hypothesis states that the nature of the interaction significantly relates to channel choice. In order to determine whether there is a significant association between these two variables, a Chi-square test of independence was conducted. A Chi-square test is designed for analyzing whether or not categorical variables are independent of one another. Categorical variables are always divided into categories, such as the variables nature of the interaction and channel choice. The variable *nature of the interaction* is divided into the categories consultation, registration, and transaction. The variable *channel choice* is divided into the categories online channel, phone, front desk, and post. In the original survey, respondents could choose between seven channels. However, the responses for mobile apps, email, and social media were too low to be used as separate categories in the Chi-square analysis and were therefore merged into one category together with website, called ‘online channel’.

A Chi-square test of independence was conducted with nature of the interaction, which was comprised of three categories (1 = consultation,

2 = registration, and 3 = transaction), and with channel choice, which was comprised of four categories (1 = online channel, 2 = phone, 3 = front desk, and 4 = post). See Table 7.

There was a significant association between the nature of the interaction and channel choice $\chi^2(6) = 39.154, p < 0.001$. Therefore, we can conclude that H1 is supported.

The statistical analysis showed that the two variables (nature of the interaction and channel choice) significantly relate to one and another. As the Chi-square is an overall test (or ‘omnibus test’), the results only reveal there is a difference between any of the cell frequencies within the contingency table, but the source of the statistically significant result remains unclear. We do not know which particular nature of the interaction is predominantly associated with which particular channel. To investigate this more thoroughly, sub H1A and H1B were posed, which are tested in the following section.

H1A states that citizens predominantly use online channels to conduct registrations and transactions, whilst H1B states that citizens predominantly use offline channels to consult with their government. We can, of course, subjectively inspect the contingency table of the Chi-square test (Table 8). This way we can see which nature of interaction is frequently associated with which channel, but this does not suffice to determine whether this difference is statistically significant (Sharpe, 2015). Therefore, post hoc analyses, or follow-up analyses were conducted in the form of calculating residuals. More specifically, adjusted residuals (z scores) for each cell of the contingency table were calculated. Residuals indicate the differences between the expected and observed frequencies within each cell. The higher the residual (e.g. the higher the difference between the expected and observed frequency), the larger the contribution of the cell to the effect of the Chi-square value. If an adjusted residual has a value > 1.96 or lower than -1.96 , it indicates a significant difference. The calculated adjusted residuals are presented in Table 8.

As becomes clear from Table 8, citizens use the online channel significantly more to conduct registrations, as the adjusted residual is > 1.96 , indicating a statistically significant effect ($z = 4.1, p < 0.05$). Furthermore, they use the online channel significantly less to consult, as this adjusted residual is smaller than -1.96 , also indicating a statistically significant effect ($z = -4.0, p < 0.05$). However, they do not significantly use the online channel more to conduct transactions, since the residual is not smaller than 1.96 ($z = -0.5, n.s.$). As H1A states that citizens mostly use online channels to conduct registrations and transactions it can be concluded that H1A can only be partly supported.

Table 6
Reliability, n, means, and standard deviations of the measures of information/navigation skills and mobile skills.

	Mean	SD
<i>Information/navigation skills (5-point scale; $\alpha = 0.835, n = 774$)</i>	3.80	0.923
I find it hard to decide what the best keywords are to use for online searches	3.90	1.155
I find it hard to find a website I visited before	4.01	1.181
I get tired when looking for information online	3.91	1.205
Sometimes I end up on websites without knowing how I got there	3.65	1.251
I find the way in which many websites are designed confusing	3.30	1.157
<i>Mobile skills (5-point scale; $\alpha = 0.792, n = 774$)</i>	3.80	1.172
I know how to install apps on a mobile device	3.91	1.400
I know how to enable and disable Wi-Fi on a mobile device	4.15	1.326
I know how to keep track of the costs of mobile app use	3.33	1.458

Table 7
Results of Chi-square test and descriptive statistics for nature of interaction and channel choice.

Channel choice	Nature of interaction		
	Consultation	Registration	Transaction
Online channel	40.6%	56.6%	44.4%
Phone	38.6%	22.3%	25.9%
Front desk	18.2%	16.2%	11.1%
Post	2.6%	4.9%	18.5%

Note. $\chi^2 = 39.154, df = 6, p < 0.001$. Percentages in table indicate column percentages.

Table 8
Calculated adjusted residuals of the Chi-square analysis.

Channel choice	Nature of interaction		
	Consultation	Registration	Transaction
Online channel	−4.0*	4.1*	−0.5
Telephone	4.6*	4.4*	−0.4
Front desk	0.8	−0.5	−0.8
Post	−2.1*	0.6	3.6*

Note. * Significant at the 0.05 level.

The data in Table 8 shows that our respondents prefer to consult with their government via the telephone, as the residual is larger than 1.96, a statistically significant effect ($z = 4.6, p < 0.05$). However, the data also shows that citizens significantly choose the telephone to conduct registrations, as this residual is also larger than 1.96 ($z = 4.4, p < 0.05$). Furthermore, the results indicate that our respondents do not significantly choose the front desk more frequently than other channels to consult with their government, as the residual is not higher than 1.96 ($z = 0.8, n.s.$). Furthermore, for the post channel, we see that citizens use this channel significantly less frequent to consult ($z = 2.1, p < 0.05$) and significantly more to conduct transactions ($z = 3.6, p < 0.05$). Therefore, it can be concluded that also H1B can only be partly supported.

5.2. Digital skills

H2 poses that digital skills significantly influence channel choice. We analyzed channel choice as a dependent variable in two different ways: (1) as in which channel citizens chose during their last contact with the government and (2) as in how frequently citizens used the website. A binomial logistic regression analysis (often simply referred to as logistic regression) was conducted to predict channel choice during last contact with government from digital skills and sociodemographic variables as predictors. A binomial logistic regression analysis is used for predicting a categorical dependent variable with two categories (e.g. a dichotomous variable) from continuous and/or categorical predictor variables. The regression predicts the probability that an observation falls into one of the two categories of the dependent variable.

For analysis purposes, dichotomous dummy variables for each separate channel were created, in order to include them as dependent variables in the logistic regression analysis. For instance, a new variable ‘front desk’ was created with two values: 1 (yes) and 0 (any of the other channels). Likewise, dichotomous dummy variables were created for all channels. Again, the channels website, mobile apps, email, and social media were merged into one category: ‘online channel’. The channel post was not included in the analysis because the number of observations was considered too low to be included in the regression analysis. For each dependent variable (online channel, phone, and front desk) separate regression analyses were conducted. The Odds Ratios (OR) were calculated for the logistic regressions to examine the likelihood

Table 9
Logistic model of predictors of all channels.

Independent variables	Online channel		Phone		Front desk	
	Odds ratio	Prob. Sign.	Odds ratio	Prob. Sign.	Odds ratio	Prob. Sign.
Constant	0.618	0.576	2.878	0.385	0.083	0.015
Digital skills (Information/navigation)	0.905	0.23	0.901	0.257	1.225	0.051
Digital skills (mobile)	1.006	0.923	1.045	0.542	0.989	0.894
Gender	1.059	0.701	0.921	0.614	0.980	0.917
Age	1.053	0.302	0.969	0.57	0.969	0.629
Education	1.063	0.27	0.903	0.09	1.057	0.439
Language	1.118	0.876	0.277	0.243	1.610	0.560

Note. None of the predictors yielded significance at the 0.05 level.

Table 10
Ordinal model of predictors of frequency of online channel choice.

	Estimate	Std. Error	Wald	df	Sig.
Digital skills (information/navigation)	−0.059	0.083	0.506	1	0.477
Digital skills (mobile)	0.043	0.066	0.422	1	0.516
Gender	0.168	0.149	1.283	1	0.257
Age	0.134	0.050	7.136	1	0.008
Education	0.097	0.055	3.042	1	0.081

of each of the events occurring, of using the online channel, phone, and front desk. An Odds Ratio higher than 1 indicates that as the predictor increases, the odds of the outcome occurring increase, and vice versa for an Odds Ratio lower than 1. The results are reported in Table 9.

As can be derived from Table 9, none of predictor variables, including digital skills, yielded significance in the regression analysis.

An ordinal regression analysis was carried out to predict channel choice, as in frequency of using the website (every week, once a month, two or three times a month), from digital skills and sociodemographic variables as predictors. An ordinal linear regression analysis is designed to predict an ordinal outcome variable by one or more ordinal or continuous-level predictor variables. Website frequency is an ordinal variable, as its categories (every week, once a month, two or three times a month) have a ranking, but the differences between them are not equal and do not have any meaning. The results of the regression are reported in Table 10.

As can be seen in Table 10, only age appeared significant, indicating that the older citizens are, the less frequently they visit the website. Contrary to our expectations, digital skills (both information/navigation and mobile) did not significantly influence channel choices. This applies for the online channel, phone, and front desk. Likewise, gender, age, and education were not significant predictors of channel choice. Further, digital skills (both information navigation and mobile) did not significantly influence the frequency of online channel choice. Furthermore, neither gender nor education were significant predictors of ‘frequency of online channel choice’. Only age was a significant predictor. Our results did not support H2.

5.3. Digital skills and website satisfaction

Our third hypothesis poses that digital skills positively influence website satisfaction.

In order to analyze the relation between these variables, a linear regression analysis was conducted. A linear regression analysis is designed to predict a continuous outcome variable from either categorical or continuous predictor variables. The regression results are reported in Table 11.

As can be derived from Table 11, digital information/navigation skills positively influence website satisfaction ($\beta = 0.24, p < 0.001$). Likewise, digital mobile skills positively influence website satisfaction ($\beta = 0.08, p < 0.05$). Furthermore, the results show that age significantly influences satisfaction ($\beta = −0.10, < 0.05$). Gender, and education were non-significant. H3 is supported.

Table 11
Linear model of predictors of website satisfaction.

	Std.		β	t	p
	B	Error			
Constant	18.147	6.049		3.000	0.003
Digital skills (information/navigation)	0.323	0.053	0.234	6.104	0.000
Digital skills (mobile)	0.09	0.042	0.08	2.103	0.036
Gender	0.058	0.095	0.023	0.608	0.543
Age	0.008	0.003	−0.094	−0.094	0.014
Education	0.027	0.035	0.029	0.765	0.444

Note. R2 = 0.08.

5.4. Correlations related to channel choice and digital skills

As our second hypothesis was, surprisingly, not supported, we performed a bivariate correlation testing (Pearson) including all the dependent and predictor variables of this study: online channel chosen as the last channel, the frequency of visiting the website, satisfaction with the website, digital skills (information/navigation and mobile), nature of the interaction types (registration, consultation, status and transaction) gender, age and education. The testing showed us the following significant correlations:

- Whether or not citizens choose the online channel in their last contact, correlated positively with website satisfaction ($r = 0.146, p < 0.01$), registration nature of the interaction ($r = 0.157, p < 0.01$) and negatively with consultation nature of the interaction ($r = -0.150, p < 0.01$).
- The frequency of visiting the websites correlated with; gender, i.e. male ($r = -0.088, p < 0.05$); correlated positively with website satisfaction ($r = 0.080, p < 0.05$) and correlated negatively with age ($r = -0.084, p < 0.05$).
- Information/navigation skills correlated with gender, i.e. female ($r = 0.073, p < 0.05$) positively with mobile skills ($r = 0.223, p < 0.01$), education ($r = 0.211, p < 0.01$), registration interaction nature of the interaction ($r = 0.127, p < 0.01$), website satisfaction ($r = 0.261, p < 0.01$), and negatively with consultation nature of the interaction ($r = -0.100, p < 0.01$).

6. Discussion

Whilst the fields of digital divide studies and eGovernment studies have been developed concurrently, it is only latterly that scholars have begun to combine the concepts of both fields to further explain adoption and use of eGovernment services. The focus in digital divide research has shifted away from a focus on first-level effects (an access divide) towards a focus on second-level effects (a skills divide) (Van Deursen & Van Dijk, 2011). As such, usage has also become a digital divide object of research. This way, eGovernment channel choice-related research and digital divide research, when conducted in the public domain, increasingly focus on the same concerns: adoption and use of electronic government channels. Early findings in digital divide literature indicate that especially in developed countries instead of an access divide, a skills related divide is much more relevant. Van Dijk and Van Deursen (2014) showed that nowadays digital skills are a key part of digital inclusion. Other researchers point out that skills are an important determinant in the take-up of eGovernment (Belanger & Carter, 2009). Therefore, it was rather surprising to find that in our study digital skills do not influence channel choice at all. The same applies to gender, and education. Only age predicts frequency of visiting the online channel (the older citizens are, the less frequent they visit the website). This diverts from Reddick & Anthopoulos' findings (2014) who find that the digital divide is one of the key predictors of channel use. However, they conceptualized the digital divide differently. Reddick and Anthopoulos (2014), used 'hours of internet use per week' and socio-demographic factors such as age, gender and education level as proxy variables for the digital divide. However, in our study the digital divide was conceptualized predominantly following findings from scholars that study the digital divide apart from eGovernment research. This means that besides socio-demographics, we focused on digital skills as one of the most important indicators in digital divide research. It is likely that this difference in conceptualization explains the differences between our findings and those of Reddick and Anthopoulos' (2014).

Our results showed that digital skills did not significantly sway citizens towards the online channel but the mere online presence of these services. This would suggest that the digital divide in skills related to the uptake of eGovernment is less relevant. It should be noted, though, that

our study was conducted in a developed country where the effects of the access divide are diminishing as a result of high adoption rates of the Internet among citizens. Arguably, our results imply that a ceiling effect has entered into force. Perhaps in the Netherlands, the adoption of eGovernment has progressed to such a high level that many variables no longer have a significant effect on the uptake of eGovernment.

But what about the effects of eGovernment usage, are these also becoming irrelevant in the face of the digital divide? We think not. Because our study also showed that digital skills do influence satisfaction of online channel usage. We think that, combined with the notion that several governments, such as in The Netherlands and in Denmark, started to make the use of several eGovernment services mandatory (Kræmmergaard & Østergaard Madsen, 2015), this result requires much more scholarly and practical attention. We believe that researchers must rethink the digital divide both in terms of scientific eGovernment research and in terms of eGovernment policies. This means that in the long run digital skills do not significantly influence the extent to which citizens adopt certain eGovernment services, however, they do influence the extent to which citizens appreciate these services. Moreover, the levels of appreciation may possibly correspond with how able they are to use them and whether or not they can handle eGovernment services the way they are meant to be used. All this, we might add, may only apply for developed countries. Other studies into eGovernment and the digital divide, such as Reddick et al. (2012), which was conducted in Egypt, a developing country, show that the access divide still matters.

7. Conclusions, limitations, and future research

In order to explore new explanations in channel choice, we incorporated further developed digital skills measurements into eGovernment research channel choice measurements. Accordingly, this research explored the citizen's perspective by studying actual channel use in the Netherlands. We found that the nature of interaction significantly coheres with channel choice. But results also show that, surprisingly, digital skills do not predict or relate to choosing the online channel. However, digital skills do predict the degree of satisfaction: the more digitally skilled citizens are, the more satisfied they are with online services. At a theoretical level, the incorporation of the digital divide perspective into channel choice research led to findings that contribute to both the eGovernment channel choice studies and to the multidisciplinary eGovernment research domain as a whole.

- First, concerning eGovernment studies combined with digital divide research, the findings implicate that when it comes to the uptake of eGovernment a divide in digital skills is more or less irrelevant. At least in developed countries. Despite these findings the incorporation of the digital divide perspective was not without value. On the contrary, it yielded new insights. We found that digital skills have an impact on experienced or perceived quality, expressed in terms of satisfaction. This could mean that, in the long run, many citizens are going to use eGovernment services anyway, no matter how skilled they are, no matter how complex these services are. Albeit for the mere fact that some governments already started to make usage of several eGovernment services mandatory. As such, channel choice research is no longer solely a matter of explaining and predicting adoption of online channels. In addition, channel choice research should also focus on what happens after adoption and how it relates to the distribution of digital skills. In other words, the impact of the digital divide on eGovernment is expanding from channel choice to channel usage.
- Second, concerning the multidisciplinary eGovernment research domain as a whole, we think that the results can contribute to the emergence of a new multidisciplinary question. Namely, what are the implications of channel use for policy implementation? Because if less digitally skilled citizens are using electronic government services

anyway, what happens to policy goals that heavily rely on online services? Think of reducing red tape, becoming more transparent, or creating a safer neighborhood through community policing. A question that cannot be answered by social or communication sciences related channel choice studies alone. Such a complicated question also needs involvement from other eGovernment related disciplines such as public administration and information sciences. As these disciplines provide a deeper understanding of policy goals such as reducing red tape towards citizens or improving societal resilience in regard to national security (see for example Duit, 2015).

A limitation that should be acknowledged is our reliance upon an online survey for data collection, which could impede making generalizations to the wider population as it is plausible that respondents participating in an online survey possess higher internet skills than the general population. However, when we compared our data to the results of a large-scale internet skills study in the Netherlands (Van Deursen et al., in press) we found that the internet skills of our respondents were only slightly higher than the average internet skills of the Dutch online population.

Another limitation is that we focused only on two sets of digital skills, namely information navigation skills and mobile skills, as we considered these skills to be most important. Further research, however, could investigate whether or not other types of digital skills, such as operational, social, and creative digital skills influence usage of the online channel, satisfaction and above all the quality of use, both from a citizen's and from a government's viewpoint. Concerning the latter, think of, for instance, knowing one's rights and obligations and behaving according thereto in many public domains, from public healthcare to paying taxes.

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