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A usability evaluation of the Obamacare website

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ABSTRACT

The healthcare.gov website, popularly called the Obamacare website, was off to a rough start. Although infrastructure issues received a great deal of media attention, the site has had its fair share of interface design problems. Drawing on the usability guidelines on the government site of usability.gov, we developed a survey instrument that comprised 16 dimensions to form overall usability. Based on a survey of 374 citizens, we found that usability strongly predicted citizen satisfaction with the website and intention to use the website. Six out of the 16 dimensions of usability emerged as significant in driving overall usability perceptions. In addition to key theoretical implications for e-government and usability research, our work offers practical implications for the healthcare.gov website and e-government web applications in general.

1. Introduction

E-government initiatives are changing the ways by which governments interact with and serve citizens. Although advancements in information and communication technologies (ICTs) provide opportunities for improving e-government interactions with citizens, it is important to consider citizens' needs and expectations to accrue the benefits of ICTs (Bertot & Jaeger, 2006). Unfortunately, e-government initiatives focus too much on the technologies themselves rather than citizens' needs and expectations (Verdegem & Verleye, 2009). Specifically, the lack of a citizen-centric design perspective has been regarded as a major reason behind underutilization of e-government initiatives (Velsen, Geest, Hedde, & Derks, 2009). Despite our knowledge about these issues with e-government implementations, we have witnessed several disappointing e-government initiatives in the past (for an example, see Nelson, 2007) and most recently, healthcare.gov (Ferenstein, 2013; Jeffries, 2013). The healthcare.gov website, popularly called the Obamacare website, is one example that warrants further examination to explore what went wrong, especially based on citizens' perceptions.

In early October 2013, healthcare.gov experienced a problematic launch that had prevented it from achieving its objective of facilitating health insurance services for millions of Americans. This problematic launch became a major national concern. Although integration/infrastructure issues (e.g., data storage, telecommunications, interoperability with other systems) were initially regarded as the major drivers of the website's poor performance, subsequent trade press reports and technology blogs steered the public's attention toward interface design issues (Dwyer, 2013).

Interface design issues concern a wide range of usability dimensions, such as the user experience, navigation and content (Thong, Hong, & Tam, 2002, 2006). For example, depending on the resolution with which users view the main page, it may not be clear to them that there is content below the virtual page fold (Cardello, 2013; Thong, Hong, & Tam, 2004; Thong, Yap, & Seah, 2000). Tomlin (2013) conducted a user experience test with users of healthcare.gov. The test revealed several issues, such as the difficulty of finding information about plans and costs, creating logins, and using the chat feature. Navigation was an issue as users needed to click many times to get the information that they needed (Shah, 2013).

Against this backdrop, this paper focuses on unearthing the specific interface design issues with healthcare.gov. One approach to understand interface design issues is a detailed usability evaluation. Usability evaluation focuses on assessing how users interact with a particular website. Although usability evaluation offers a mean to better understand users' impressions of a website, there appears to be limited use of usability evaluation in e-government initiatives (Bertot & Jaeger, 2006). In the context of healthcare.gov website, a complete end-to-end testing had not been properly conducted prior to its launch (Pear, 2013). This is surprising as government agencies have invested in developing and disseminating usability guidelines (Bertot & Jaeger, 2006). The usability.gov website, for instance, provides comprehensive research-based guidelines for designing and maintaining websites (U.S. Department of Health and Human Services, 2006) and could have been leveraged to conduct a usability evaluation for the healthcare.gov website.

We conducted a usability evaluation of healthcare.gov based on usability.gov guidelines to gain insights into interface design issues from the citizens' perspective. We used the usability.gov guidelines to develop a usability instrument that was used to evaluate the usability of healthcare.gov. This approach is expected to produce insights about interface design that can help determine key usability issues, reveal

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problematic issues as perceived by citizens, and set us on course to remedying the problems. Having a practice-based usability evaluation method can also aid theory development and rigorous yet relevant research in the e-government domain.

2. Background

Drawing from the International Standards Organization's (ISO) definition of usability, we define e-government website usability as the extent to which a website can be used by citizens to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified e-government service context (adapted from Venkatesh & Ramesh, 2006). It has been argued that usability is a key proximal metric for evaluating the success of an organization's web presence (Agarwal & Venkatesh, 2002; Venkatesh & Agarwal, 2006) and government organizations are no exception (Donker-Kuijer, Jong, & Lentz, 2010; Rai, Song, & Troutt, 1998).

Usability has been extensively studied in various settings and for different applications, such as web and mobile portals (Hoehle & Venkatesh, forthcoming; Venkatesh & Agarwal, 2006; Venkatesh & Ramesh, 2006). In the context of municipal government websites, Youngblood and Mackiewicz (2012) examined usability based on popular usability metrics, such as the W3C. The test revealed problems pertaining to the use of navigation techniques, such as the breadcrumb trail. Using the information success model (Delone & McLean, 1992) as basis for evaluating satisfaction with online tax-filing systems, Chen (2010) found a significant impact of information quality (assessed in terms of accuracy, timeliness, and completeness) on taxpayer satisfaction. Usability (assessed in terms of help, ease of navigation, and layout and design) has also been identified as a determinant of user satisfaction (Verdegem & Verleye, 2009). Agarwal and Venkatesh (2002) developed a usability instrument using the Microsoft Usability Guidelines (MUG), which were synthesized to represent five usability categories: content, ease of use, promotion, made-for-the-medium, and emotion. The categories were further divided into sub-categories, empirically examined, and found to explain site usability and use in both web and wireless contexts. For example, content has been shown to be a significant determinant of both website and wireless site usability (Agarwal & Venkatesh, 2002; Venkatesh & Agarwal, 2006; Venkatesh & Ramesh, 2006). In sum, usability problems can have serious ramifications in terms of trust in government and pursuing online government services by citizens (Rai, Ravichandran, & Samaddar, 1998; Youngblood & Mackiewicz, 2012).

One approach to detect usability problems is the use of surveys. Although surveys represent a convenient approach to reach a large number of real e-government users, their use in the e-government literature has lacked sufficient rigor and relevance. Elling, Lentz, Jong, and Bergh (2012) indicated that many usability questionnaires lack a solid statistical basis and justification for the usability questions (Hornbæk, 2006). For large scale and costly projects, such as e-government websites, it is necessary to develop and use well-founded questionnaires. There are several heuristic approaches and survey instruments that provide valuable insights into e-government initiatives. For example, Elling et al. (2012) identified seven dimensions to evaluate government websites: ease of use, hyperlinks, structure, relevance, comprehension, completeness, and layout. When these seven dimensions are juxtaposed with the usability.gov guidelines, we can see that the usability.gov guidelines provide additional dimensions, such as the overall user experience and hardware/software. Also, based on the comprehensive nature of the usability.gov guidelines, they are better suited to test interactive government websites that offer complex services, such as health insurance and tax filing.

Our observations from the literature on the usability of e-government websites coupled with the unfortunate issues with healthcare.gov drive the importance of this research. We use the usability.gov guidelines as the basis to conduct a usability evaluation of healthcare.gov. Consistent with Rosemann and Vessey (2008), we choose to examine usability.gov guidelines as a practical intervention using a well-established rigorous research approach. In addition, our research perspective balances the validity of research models with enough details to provide guidance to designers and e-government project managers to proactively manage the implementation of e-government initiatives, especially healthcare.gov.

3. Outcomes of interest

To demonstrate the effectiveness of the identified design dimensions, we use citizen satisfaction and intention to use the system (here, the healthcare.gov website) as outcome variables. Intention to use has been established as a good predictor of a variety of behaviors including technology use (for reviews, see Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Davis, & Morris, 2007). Satisfaction is often used as a success indicator for technological innovations (Chan et al., 2010; Venkatesh, Chan, & Thong, 2012). Both outcome variables are widely used in the e-government literature to demonstrate the effectiveness of e-government services (Chen, 2010; Venkatesh et al., 2012) or specific e-government applications (Schaupp, Carter, & McBride, 2010). Further, both outcome variables are used across different contexts of e-government initiatives, whether in mandatory (for an example, see Chan et al., 2010) or voluntary settings (for an example, see Hung, Chang, & Yu, 2006). However, satisfaction is considered an appropriate dependent variable especially when the system is large scale and use is mandated (Brown, Venkatesh, Kuruzovich, & Massey, 2008; Chan et al., 2010).

3.1. Intention to use

Intention to use has played an important mediating role between user's beliefs and technology use (Brown & Venkatesh, 2005). E-government studies that apply technology acceptance models, where intention to use the website is a key variable, have consistently explained actual use, with intention to use an e-government application or service as a mediator (Hung et al., 2006; van Dijk, Peters, & Ebbers, 2008). Other studies have focused solely on explaining intention to use. For example, Schaupp et al. (2010) examined antecedents to the intention to use an e-file system for tax processing. Intention to use the system or website has been also predicted by usability (with a special emphasis on ease of learning and ease of use), computer resource requirement, technical support provision, and security provision (Venkatesh et al., 2012).

3.2. Satisfaction

Satisfaction reflects users' personal impressions of systems, which are important components of usability evaluation (Bertot & Jaeger, 2006). Satisfaction has been emphasized in usability research mainly because it influences large scale adoption and use of e-government services (Verdegem & Verleye, 2009). User satisfaction with online public services has been measured by identifying factors that are deemed important from the user perspective (Verdegem & Verleye, 2009). The factors pertain to infrastructure, availability, awareness of the e-government website, technical aspects, content, usability, and security of the transactions. Verdegem and Verleye's (2009) measurement approach asked users to indicate the extent to which they are satisfied with each of the identified factors. Another approach to examine satisfaction with e-government applications is to measure the impact of antecedents (e.g., information quality, system quality, service quality) on the overall satisfaction with the system (Chen, 2010). In the context of mandatory e-government applications, Chan et al. (2010) found that key technology adoption variables (e.g., performance expectancy, facilitating conditions, social influence) are key predictors of citizen satisfaction (with a special emphasis on continuing to use the system). In

the context of government self-service technologies, Venkatesh et al. (2012) tested and found that smartcard technology use had a positive effect on satisfaction. In addition, their study revealed the importance of population segments (e.g., usability focused, balanced, risk-conscious) to better understand users' priorities in terms of technology preferences, which ultimately influenced their satisfaction (Venkatesh et al., 2012). Despite different conceptualizations, measurements and examination approaches, satisfaction has been deemed an important objective of e-government initiatives/services.

4. Method

4.1. Research setting

We collected data related to the usability of the healthcare.gov website. Healthcare.gov is an exchange portal that was designed by the U.S. government to provide citizens with healthcare insurance products. Several sources estimated that the development costs for healthcare.gov surpassed $500 million by October 2013. The website was rolled out, as planned, on October 1, 2013, despite the concurrent U.S. government shutdown. Subsequent to the roll out, various sources (e.g., news media outlets) reported severe technological issues including weak back-end construction and usability related issues. Issues related to healthcare.gov prevailed for several weeks and on October 21, 2013, President Obama addressed the healthcare.gov glitches and released a press statement: "Healthcare.gov hasn't worked out as smoothly as it was supposed to work. There's no sugar coating—the website has been too slow, people have been getting stuck during the application process and I think it's fair to say that nobody's more frustrated by that than I am" (CBS, 2013).

4.2. Participants

Approximately six weeks after the launch of healthcare.gov, we collected data from U.S. citizens who had been exposed to the website. We employed a market research firm to collect the data and the firm sent out email invitations to potential respondents—i.e., those on the sampling frame. All invited citizens were asked to complete our online survey and the market research firm provided a small monetary incentive to encourage participation. In total, we obtained 374 (217 women) usable responses and the participants came from a variety of occupations and income groups. As shown in Table 1, many respondents were relatively young. We expected that older citizens, relative to younger citizens, may be less receptive to e-government services in general due to greater perceptions of effort as older citizens are not likely to have grown up with technology and have less experience with it (Powell, Williams, Bock, Doellman, & Allen, 2012). Moreover, users who were originally registered in the consumer panel tended to be younger. In addition, responses from younger citizens are justifiable in the study context because they are eligible to apply for the e-government health service through the examined portal (see Compeau, Marcolin, Kelley, & Higgins, 2012). Table 1 provides more detailed demographic information about the respondents.

Finally, because our sample matched the sampling frame provided by the market research firm, we felt that non-response bias was not a concern. Further, comparing early vs. late responses was not deemed useful because the market research firm collected all responses during a single week around the middle of November, 2013 and no reminders were sent out (see Hair, Anderson, Tatham, & Black, 1998)

Table 1
Respondent demographics.

Demographic	Category	n = 374	%
Gender	Men	157	42
	Women	217	58
Age groups	Under 20	40	10.7
	20–29	199	53.2
	30–39	70	18.7
	40–49	25	6.7
	50–59	28	7.5
	60 or older	12	3.2
Job	ICT	39	10.4
	Banking and Finance	7	1.9
	Insurance, Real Estate and Legal	3	0.8
	Government and Military	5	1.3
	Medical Healthcare	30	8.0
	Construction and Engineering	18	4.8
	Retail and Wholesale	25	6.7
	Education	63	16.8
	Marketing and Advertising	9	2.4
	Student	75	20.1
	Other	100	26.7
Income	Under 10,000	57	15.2
	10,000–19,999	38	10.2
	20,000–29,999	38	10.2
	30,000–39,999	35	9.4
	40,000–49,999	36	9.6
	50,000–74,999	37	9.9
	75,000–99,999	38	10.2
	100,000–150,000	53	14.2
	Over 150,000	42	11.2

4.3. Procedure

The data were collected using an online survey that included instructions for the participants and all items. The survey was created based on existing and publicly available website usability guidelines that were developed by the U.S. Department of Health and Human Services (HHS). More details about the process of creating the survey are provided in the next section. Before asking the market research firm to distribute our survey to a large sample, we asked two researchers to read the instructions and provide us with feedback on the items and the survey structure in general. Both individuals had a few minor suggestions—e.g., pagination—and indicated that the instructions were clear and easy to follow.

To ensure that all respondents could meaningfully respond to items related to the usability of healthcare.gov, we developed two alternative versions of the survey. One version included a short video clip that was developed to illustrate the user interface of the healthcare.gov website. The video clip showed a sequence of steps that citizens could perform on healthcare.gov and lasted approximately 4 min. The second version of our survey included 12 screenshots from healthcare.gov to illustrate the functionalities and user interface of the website. To make sure that both versions of the survey displayed similar content, we aligned the content of the screenshots with the content shown in the video clip. We also asked respondents if they had used healthcare.gov prior to taking our survey and we asked the following question at the beginning of the online survey: what is the frequency with which you access healthcare.gov? We found that 144 respondents had used healthcare.gov. Prior to our analyses, all responses were screened for completeness and accuracy. We excluded those respondents who did not correctly answer reverse-coded filler items and we dropped responses that did not meet the time threshold for survey completion, as determined by the market research firm.

4.4. Measurement

We adapted the guidelines provided on usability.gov to develop our survey instrument. The usability.gov guidelines were developed by the U.S. Department of HHS, which collaborates with federal agencies and individuals in both the private and public sectors to produce content and share trends on the user experience in general (Usability.gov, 2014). According to Michael O. Leavitt, Secretary of HHS, the guidelines have been widely used by government agencies and NGOs. The guidelines are publicly available on the usability.gov website, which is maintained by the Digital Communications Division in HHS. Usability.gov's

guidelines comprise 18 chapters and focus on user experience related issues for websites. For instance, one chapter focuses on the navigation of websites and identifies the most critical components of effectively navigating pages (e.g., placing primary navigation menus in the left panel). To start the instrument development process, we systematically reviewed and analyzed usability.gov's guidelines. Because chapter 1 and chapter 18 of the guidelines focus on the processes of design and testing rather than actionable interface design recommendations, we excluded both chapters from our analysis. Strauss and Corbin's (1990) open and axial coding procedures were followed to identify conceptually similar themes discussed in usability.gov's guidelines. The fact that the chapters were originally organized in the manual by design topics facilitated the coding process. We organized the derived codes in a data matrix, as outlined by Miles and Huberman (1999). We also reviewed literature on website usability assessment and compared it with the identified codes. To identify relevant literature, we conducted a keyword search in leading government, human–computer interaction, and management information systems journals. We searched for various keywords including usability, web usability, e-government usability and interface usability. Table 2 illustrates the procedure for comparing initial usability dimensions, codes derived from the usability.gov's guidelines, and relevant existing literature.

Next, we studied the identified articles for how website usability was conceptualized, associated scales used to measure website usability, and the suggested usability evaluation methods. We then related the information derived from the usability.gov guidelines to the literature and found additional support for the information derived from the usability.gov guidelines. Based on this analysis, we defined 16 constructs representing healthcare.gov's usability. Table 3 shows the constructs and associated definitions of our e-government usability conceptualization.

Based on the construct definitions, we developed items that captured the content of the 16 usability dimensions. In total, we created 205 items representing the constructs shown in Table 3. We also used a 10-item overall measure of website usability that we adapted from the UsabilityNet website (UsabilityNet, 2003), which is referenced by usability.gov. In order to measure the outcome variables, we adapted citizen satisfaction measures from Venkatesh et al. (2012) and intention to use from Brown and Venkatesh (2005). All items were measured using a 7-point Likert-agreement scale (1 = strongly disagree… 7 = strongly agree). A full list of the items is provided in Appendix A. Respondents were also given the option to select "don't know" as their answer. We note that overall usability was measured using formative indicators because they tap into distinct dimensions (see Petter, Straub, & Rai, 2007 for a detailed discussion). As explained later in greater detail, we modeled the 16 dimensions as first-order constructs determining the overall second-order usability construct. Following prior research, both outcome variables—i.e., citizen satisfaction and intention to use—were measured reflectively. We employed age, gender (binary variable with women coded as 0 and men coded as 1), and income (coded from 1 to 9, based on the ranges shown in Table 1) as control variables in all models following prior work on usability and technology

Table 3
List of usability dimensions based on usability.gov guidelines.

Dimension	Definition
	The degree to which a user perceives that the website…
Access	…facilitates access to relevant information.
Content	…provides needed information.
Content organization	…presents information that is clearly organized.
Graphs	…uses graphics appropriately.
Hardware and Software	…accommodates to different hardware and software settings (e.g., operating systems, browsers, screens).
Headings, titles and labels	…uses descriptive headings, titles, and labels.
Home page	…has a home page that is well constructed.
Links	…uses meaningful link labels and consistent clickability cues.
List	…uses clear, meaningful, and descriptive lists.
Navigation	…allows finding and accessing information effectively and efficiently.
Page layout	…has a structure of pages that facilitates comprehension.
Screen	…uses familiar screen-based controls in a conventional manner.
Scrolling and Paging	…allows moving within a page and across pages efficiently.
Search	…uses appropriate and useful search mechanisms.
Text	…communicates text effectively.
User experience	…facilitates and encourages effective and efficient interactions.

Table 2
Interplay between usability.gov guidelines and relevant literature.

Dimension	Examples of open codes	Examples of relevant literature
Access	• Users should have several alternatives for viewing multimedia elements that communicate content effectively.	Agarwal & Venkatesh (2002)
Content	• Terminology should be familiar to users to improve their understanding of the content.	Elling et al. (2012); Nielsen & Tahir (2002); Verdegem & Verleye (2009)
Content organization	• Content should be organized in a way that supports locating information efficiently.	Agarwal & Venkatesh (2002); Elling et al. (2012)
Graphs	• Users should be able to easily integrate images and associated text.	Agarwal & Venkatesh (2002); Nielsen & Tahir (2002)
Hardware and Software	• Users should be able to view the website content easily and quickly with their own system settings.	Nielsen (1997); Palmer (2002)
Headings, titles and labels	• Category labeling should reflect the content within a particular category.	Nielsen & Tahir (2002)
Home page	• Users should be able to tell the purpose of the website from the homepage.	Elling et al. (2012); Nielsen (2003)
Links	• Users should be able to recognize links to relevant content easily.	Elling et al. (2012); Palmer (2002)
List	• Users should be able to recognize items as a discrete list through meaningful structure and formatting.	Nielsen & Tahir (2002)
Navigation	• Users should be able to easily navigate the website through organized menus.	Lee & Kozar (2012); Palmer (2002)
Page layout	• Pages should be structured in a way that minimizes the need to remember several page items.	Nielsen & Tahir (2002); Palmer (2002)
Screen	• Errors in data entry should be easily identified and clearly explained to users.	Seckler, Tuch, Opwis, & Bargas-Avila (2012)
Scrolling and Paging	• Users should be able to scroll easily through well-organized pages.	Lee & Kozar (2012); Nielsen & Tahir (2002)
Search	• Users should be able to use the search results easily to solve any navigation issues.	Elling et al. (2012); Kim & Chang (2007)
Text	• Text formatting should be appropriate to ensure fast reading and comprehension. • Formatting should be consistent throughout the website to improve readability and reduce task completion time and errors.	Bernard, Chaparro, Mills, & Halcomb (2003); Lee & Kozar (2012)
User experience	• The website should utilize different mechanisms to increase users' perceptions of credibility (e.g., links to outside sources, professional design). • The website should utilize appropriate mechanisms to provide feedback to users while they browse through the website.	Agarwal & Venkatesh (2002); Fogg (2002); Lee & Kozar (2012)

acceptance research (see Chan et al., 2010; Venkatesh et al., 2012). In addition, we controlled for the political opinion of the respondents and asked them regarding their voting behavior in 2008 and 2012 (two categorical variables for 2008 and 2012 to indicate whether or not a respondent voted for Obama in the past, with voting for Obama being coded as 0 and not voting for Obama being coded as 1). E-government research suggests that voting behavior is particularly suited to explain e-government technology adoption (see Velsen et al., 2009).

5. Results

To estimate the model, we used partial least squares (PLS), a component-based structural equation modeling technique that aims to maximize the variance explained in estimating the specified model. The software package we used was Smart-PLS 2.0 (Ringle, Sven, & Alexander, 2005). We started our analysis by assessing whether pooling of the datasets (screenshots vs. video clip) was possible following the procedure outlined by Venkatesh et al. (2003). Appendix A provides descriptive statistics of the usability dimensions and the outcome variables.

5.1. Measurement model

To assess the psychometric properties of the scales, we examined item loadings, internal consistency reliability (ICRs) and average variance extracted (AVEs) of our scales. The results indicated that the loadings of the scales were adequate, with loadings greater than .70 and cross-loadings were less than the loadings, suggesting internal consistency and discriminant validity (Fornell & Larcker, 1981; Nunnally, 1978). Further, the fact that no inter-construct correlations were greater than the square root of the AVEs provided evidence of discriminant validity. Table 4 presents ICRs, AVEs, overall descriptive statistics, and inter-construct correlations for the control variables and reflectively measured constructs.

5.2. Structural model

We initially investigated the inter-construct correlations between the second-order and first-order usability constructs. The formative first-order constructs explained 89% of variance in the second-order usability construct. Six of the first-order usability dimensions significantly contributed to the second-order usability construct. The weight obtained for user experience was highest among the usability dimensions (0.51), followed by content organization (0.31), followed by navigation and screen (both 0.17), as well as graphs and list (both 0.15). Table 5 shows the variance explained in the second-order usability construct by the first-order usability constructs. Table 5 is critical because it tells us which dimensions are significant and which ones are not.

Next, we examined the structural model results, which are shown in Table 6. In explaining citizen satisfaction, none of the control variables including voting behavior was significant. Usability was a strong predictor of citizen satisfaction. In explaining intention to use, once again, usability emerged as a strong predictor. The model explained 62% and 18% of the variance in citizen satisfaction and intention to use, respectively.

6. Discussion

The increasing cost and underutilization of large scale e-government initiatives are major issues with which governments struggle. This research underscores that e-government initiatives should take a citizen-centric design perspective (see Bertot & Jaeger, 2006; Velsen et al., 2009) as one approach to overcome such issues. We conducted a usability evaluation of a recent large scale e-government initiative, namely healthcare.gov, to unearth specific design issues from the perspective of citizens. Our research is among the first to develop and validate a fine-grained instrument based on official guidelines to measure the usability of e-government websites/portals. We contribute to usability research by complementing work that used other official guidelines (e.g., Microsoft usability guidelines) in commercial websites (Venkatesh & Agarwal, 2006; Venkatesh & Ramesh, 2006) and extend this work to large scale e-government websites. In addition, our work addresses the need for more rigorous usability evaluations of e-government portals (Elling et al., 2012; Hornbæk, 2006). Healthcare.gov provided the setting for developing and validating the instrument (U.S. Department of Health and Human Services, 2006). The findings confirmed that our conceptualization and instrument were strong predictors of citizen satisfaction and intention to use. Our research offers several implications for theory and practice.

6.1. Theoretical implications

We believe that our research makes a theoretical contribution in two relevant e-government research streams: adoption/IS success and usability. The adoption/IS success research stream (e.g., Chan et al., 2010; Chen, 2010; Venkatesh et al., 2012) uses the theoretically grounded information systems success model (Delone & McLean, 1992) and technology adoption models (Venkatesh et al., 2003). These models theorize that independent variables, such as ease of use and information quality, are key predictors of information systems use (Thong et al., 2002, 2006; Venkatesh, 1999, 2000). Our approach complements research on the adoption and success to specifically explain why citizens perceive information quality (Delone & McLean, 1992), for instance, as high. For example, the identified constructs *content* and *content organization* cover detailed design components, such as comprehension, structure and formatting of information. The usability research stream in e-government already recognizes the need to incorporate

Table 4
Reliabilities, AVEs, descriptive statistics, and correlations.

	ICR	Mean	SD	1	2	3	4	5	6	7	8
1. Age	NA	31.17	11.68	NA							
2. Gender	NA	0.42	0.49	.00	NA						
3. Income	NA	5.71	3.41	.07	−.04	NA					
4. Vote (2008)	NA	1.47	0.50	−.17***	.05	.03	NA				
5. Vote (2012)	NA	1.40	0.49	−.07	.03	−.03	.68***	NA			
6. Intention to use	0.97	3.70	2.07	.03	.06	−.06	−.26***	−.25***	.96		
7. Usability	NA	4.64	1.13	−.07	−.09*	−.02	−.22***	−.29***	.36***	NA	
8. Citizen satisfaction	0.86	4.07	0.80	−.08	−.06	.02	−.20***	−.29***	.29***	.78***	.83

Notes:
1. n = 374.
2. ICR: Internal consistency reliability.
3. Diagonal elements are the square root of the shared variance between the constructs and their measures; off-diagonal elements are correlations between constructs.
4. NA: Not applicable.
5. * $p < .05$; *** $p < .001$.

Table 5
Relating the second-order usability construct to the first-order usability constructs.

	Weights
R^2	0.89
Usability dimensions (weights)	
Access	−0.02
Content	−0.02
Content organization	0.31***
User experience	0.51***
Graphs	0.15*
Home page	0.03
Headings, titles and labels	−0.10
Hardware and Software	−0.04
Links	−0.09
List	−0.15*
Navigation	0.17**
Page layout	0.13
Screen	0.17**
Scrolling and Paging	0.03
Search	−0.05
Text	−0.06

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

design dimensions (Elling et al., 2012) but leaves room for including more detailed design dimensions, especially in the context of interactive and complex e-government websites. In that regard, we leverage the usability.gov guidelines to offer a more comprehensive usability instrument. The quantitative analysis of the instrument supports our premise that more comprehensive and accurate conceptualizations and scales are needed to better understand the effectiveness of e-government website design from the perspective of citizens. The usability instrument explains 89% of the variance in the usability of healthcare.gov. The dimensions that were the strongest predictors of usability were user experience, content organization, navigation, screen, graphs, and list.

As governments strive to improve citizen satisfaction with e-government initiatives and increase the utility of their websites/portals, it becomes important to identify design factors that are significantly related to citizen satisfaction and a citizen's intention to use the application (Thong et al., 2000, 2004). E-government studies on citizen satisfaction in particular, whether those in the usability research stream (Verdegem & Verleye, 2009) or the acceptance/success stream (Chen, 2010), need to incorporate more comprehensive and accurate conceptualizations, as discussed earlier, to better explain citizen satisfaction. For example, the current study extends the design dimensions that were identified by Verdegem and Verleye (2009) to include more detailed items on scrolling, home page, and the overall user experience. With a more comprehensive instrument, we were able to explain 62% of the variance in citizen satisfaction and 18% in the intention to use healthcare.gov.

A notable strength of this research is that it draws on practitioner-based resources to develop a usability instrument for e-government portals. In addition, although the original guidelines from usability.gov are based on the accumulation of results from a series of different studies (U.S. Department of Health and Human Services, 2006), the current study extracts and empirically examines the usability dimensions in one instrument with a real e-government portal. Rosemann and Vessey (2008) suggest that relevant research involves examining a practical intervention using a rigorous research approach. Our study followed this approach and employed the usability.gov guidelines to explain citizen satisfaction and the intention to use healthcare.gov.

Table 6
Structural model results.

	Citizen satisfaction	Intention to use
R^2	0.62	0.18
Control variables		
Age	−0.04	0.03
Gender	0.01	0.10
Income	0.04	−0.05
Vote 2008	0.01	−0.15*
Vote 2012	−0.08	−0.05
Key predictor		
Usability	0.76***	0.33***

* $p < 0.05$.
*** $p < 0.001$.

6.2. Practical implications

Our findings are of value to governmental agencies and policy makers. The findings provide insights on the usability evaluation of e-government portals/websites. For government and policy makers who are involved in the planning and decision making of e-government initiatives, it is important to allow sufficient time and resources for usability evaluation from the perspective of citizens. Press reports and technology blogs that analyzed issues with healthcare.gov continue to point to interface design issues as a major contributor to the problematic launch of the website (Dwyer, 2013). Hence, our study provides insights that not only support opinions regarding the importance of interface design issues, but also present specific empirical evidence that unearths the citizens' perceptions of different design dimensions and their impact on citizen satisfaction and the intention to use healthcare.gov. In addition, the demonstrated predictive validity of the usability instrument is expected to provide a tool to maintain and monitor the performance of e-government portals, especially healthcare.gov, with existing design features or in case new design features are needed to improve the online health insurance application process.

The findings also provide guidance to system designers. To improve the usability in the context of e-government portals, designers need to focus on the user experience, content organization, screen, navigation, and page layout (Thong et al., 2000, 2004). The official usability.gov manual assesses all usability guidelines based on strength of evidence and relative importance. For example, guidelines within the user experience chapter that pertain to providing assistance to users who need additional help with the website were rated low on relative importance and those about developing pages that will print properly were rated low based on strength of evidence (Usability.gov, 2014, p. 18, 21). Guidelines within the navigation chapter that pertain to using site maps and using appropriate menu types were rated low on relative importance (Usability.gov, 2014, p. 67, 68), whereas those about providing navigational options and feedback on user location were rated low on strength of evidence (Usability.gov, 2014, p. 59, 62). Although we do not rate the guidelines in a similar manner, our results suggest that some of the items representing each guideline, including those that received low ratings in the original usability manual, were significant when aggregated to represent some of the examined usability dimensions (e.g., navigation, user experience) and predict satisfaction and intention to use the website. Hence, our results provide empirical evidence when the overall guidelines are considered to assess usability in relation to the outcomes of interest. In summary, the extracted items should be useful in the requirements engineering process as the items help designers and stakeholders in discussing and prioritizing the design requirements of e-government initiatives. The U.S. government could leverage the instrument to conduct studies over time to see the efficacy of the changes that they implement—such as the changes that went into effect at the end of November, 2013.

7. Future research

Our research contributes to the development of a citizen-centric design for e-government by introducing a fine-grained usability instrument. Although the importance of such a perspective has been acknowledged in the e-government literature, there has been a limited

use of usability instruments in e-government initiatives (Bertot & Jaeger, 2006). Our usability instrument is based on practical guidelines, which have been rigorously validated. However, there is still a room for future research to contribute to the development and dissemination of the citizen-centric design perspective. For example, the citizen-centric design perspective requires monitoring and meeting citizens' expectations. With the increasing diffusion of smartphones (Gartner Research, 2013) and their diverse applications in banking, healthcare and retailing, citizens might expect well-designed mobile e-government websites. This provides an opportunity to adapt and test our instrument in the context of mobile e-government services.

Researchers can also use our usability conceptualization and instrument in new contexts or test the stability of the scales over time (Ancona, Okhuysen, & Perlow, 2001; Johns, 2006). For instance, future research could study existing e-government websites besides healthcare.gov, such as websites from the Department of Education, Department of Commerce and Department of Homeland Security. Evaluating our usability conceptualization and associated instrument with alternative e-government services (e.g., tax filing services, voting systems, vehicle registration and titling, checking traffic information, booking public facilities) is also critical in order to see if the results are comparable in terms of predicting outcomes of interests (see Alvesson & Kärreman, 2007; Hong, Chan, Thong, Chasalow, & Dhillon, 2014; Johns, 2006). Future research could also leverage and/or adapt our usability instrument and study if the characteristics of specific e-government services (e.g., complex vs. simple services, routine services vs. non-routine services) moderate the effect of the usability dimensions on the outcomes studied here or if the role of important others has important direct or interaction effects (see Sykes, Venkatesh, & Gosain, 2009; Sykes, Venkatesh, & Johnson, 2014). For instance, Venkatesh et al. (2012) studied several e-government services that varied in terms of service complexity and found that usability, computer resource requirement, technical support provision and security provision were critical predictors of e-government acceptance among citizens. Future research could build on this work and use our detailed instrument and study the relative importance of the usability dimensions in combination with a variety of e-government services.

8. Conclusion

We adapted the usability guidelines from usability.gov to evaluate the usability of the healthcare.gov website. The guidelines provided a rich source that was leveraged to conceptualize a set of 16 usability dimensions and associated items that capture detailed design aspects of e-government websites. We found that usability was a strong predictor of citizen satisfaction and intention to use. Specifically, the key determinants of overall usability that played a role were: content organization, user experience, graphs, list, navigation, and screen. These dimensions provide key leverage points to improve the healthcare.gov website. The instrument itself provides a starting point for the evaluation of e-government sites for a variety of services and for the development of similarly rigorous usability instruments to evaluate other types of e-government websites.

Appendix A

As indicated earlier, we started our analysis with assessing whether pooling of the datasets (screenshots vs. video clip) was meaningful following the procedure outlined by Venkatesh et al. (2003). The results suggested that pooling the datasets across both versions (screenshots vs. video clip) of the survey was appropriate because there were no significant differences in descriptive statistics across both versions.

Table A1
Descriptive statistics for video clips and screenshots.

	Video clip		Screenshots	
	Mean	SDev	Mean	SDev
Intention to use	5.00	1.33	5.00	1.20
Citizen satisfaction	4.02	0.77	4.10	0.82
Usability dimensions	5.04	1.33	5.05	1.18
Access	5.00	1.38	4.92	1.26
Content	4.96	1.31	4.85	1.23
Content organization	4.83	1.26	4.80	1.18
User experience	4.99	1.35	5.00	1.20
Graphs	5.02	1.38	4.99	1.20
Home page	5.05	1.33	4.99	1.19
Headings, titles and labels	5.02	1.34	4.99	1.17
Hardware and Software	4.96	1.28	4.91	1.20
Links	4.94	1.31	4.99	1.18
List	4.99	1.40	4.91	1.24
Navigation	4.94	1.46	4.95	1.22
Page layout	4.83	1.42	4.77	1.29
Screen	5.10	1.32	5.14	1.16
Scrolling and Paging	5.00	1.33	5.00	1.20
Search	5.04	1.33	5.05	1.18
Text	5.00	1.38	4.92	1.26

Table A2
List of items with descriptive statistics on the construct level.

Construct	Mean	SDev	Cron. α	Item
Access	4.90	1.25	0.97	The content is accessible to me. I can complete and submit online forms. I have the option to convey the information with and without color. I can skip repetitive navigation links.

(continued on next page)

Table A2 *(continued)*

Construct	Mean	SDev	Cron. α	Item
				There is a text equivalent for every non-text element that conveys information.
				I can view the content without any difficulty with applets or plug-ins.
				I have the option to view text-only pages with equivalent information and functionality.
				I can easily and quickly navigate through images.
				I can easily view multimedia presentations (e.g., movie or animation).
				The content is easy to read.
				Information is logically portrayed.
				Title sections facilitate identification and navigation of sections.
				There is no screen flicker.
Content	5.04	1.25	0.96	Describes tasks in a clear sequence.
				Uses easy to understand terms.
				Words are familiar to me.
				Acronyms and abbreviations are familiar to me.
				Abbreviations are used appropriately.
				Complete words are displayed rather than abbreviations only.
				Uppercase and lowercase letters are appropriately used.
				Content uses appropriate number of words in sentences.
				Content uses appropriate number of sentences in paragraphs.
				Page text is succinct.
				Page text is written in active voice.
				Instructions are clearly written.
				Important information is placed in the first sentence in each paragraph.
Content organization	4.95	1.31	0.97	Information has a clear structure.
				Information has a logical structure.
				I can easily find desired information.
				I can easily find all needed information when and where it is needed.
				Related information and functions are grouped together.
				I can easily find critical information close to the homepage.
				The use of tables, graphics, and visualization techniques is appropriate.
				The right amount of information is displayed.
				Information is provided in multiple formats.
				Information is provided at different levels of detail.
				Colors for categorizing information are appropriate.
Graphs	4.81	1.21	0.98	Simple background is used behind text.
				Clickable images are labeled clearly.
				Images load quickly.
				Video, audio, and animation are meaningful.
				The logo is placed consistently.
				I can easily distinguish important images.
				Images are placed appropriately.
				I can understand the message conveyed through the images.
				Images are interesting.
				Graphs use appropriate annotation.
				Graphic displays detect critical changes.
				Animation is clearly explained prior to viewing.
				I can easily pause, stop, replay, or ignore the animations or other multimedia elements.
				Images look like real-world objects (e.g., small house image to represent homepage).
				Images that indicate 'Home' or 'Next' are appropriate.
				Provides a thumbnail of the image when viewing full-size images is not critical.
				The images enhance my learning.
				Photographs of people are meaningful.
Hardware and software	4.50	1.26	0.93	I can view the content effectively with my browser.
				I can view the content with any settings in my browser.
				I can view the content effectively with my own operating system.
				I can view the content effectively with my Internet connection speed.
				I can view the content effectively with my screen resolution.
Headings, titles, and labels	5.00	1.28	0.96	Category labels clearly reflect the information and items contained within the category.
				The browser title bar uses clear and meaningful text.
				Page headings are unique from one another.
				Page headings are related to the content they describe.
				Page headings are clear and understandable.
				Important page items that require my attention are visually distinguished.
				Data tables use clear row and column headings.
				The headings help me get a sense of the hierarchy of information on the page.
				I can focus first on what I consider to be the most important option.
Home page	5.00	1.26	0.95	I can access the homepage from any other page.
				I can easily view the structure of the major options on the homepage.
				The homepage gives me a positive first impression.
				The purpose and value are clearly communicated on the homepage.
				I do not have to read large amounts of text on the homepage.
				I can easily identify the homepage.
				The homepage content is presented as only one screenful.
				The homepage announces major changes.
				I can easily recognize homepage panels.
Links	5.02	1.26	0.97	Link labels are meaningful.
				Link labels are understandable.
				Link labels are easily differentiated.

Table A2 *(continued)*

Construct	Mean	SDev	Cron. α	Item
				Related content is linked.
				The link text is consistent with the title or headings on the destination.
				I can easily distinguish items that are clickable.
				I can access important content from more than one link.
				Uses text links.
				The link color changes when it is clicked.
				Uses cues to indicate items that are clickable.
				The link text accurately describes the link's destination.
				I can easily point and click on links.
				The link provides information on whether it will take me to a different location on the same page or to a new page on a different page.
				Clickable sections of a clickable image are obvious.
				Links are provided to clarify technical concepts or jargon.
List	5.00	1.25	0.96	Lists are arranged is such a way that facilitates my task.
				Important items are placed at the top of the list.
				The lists are easy to understand.
				Related items are displayed in a vertical list.
				The list heading presents a clear indication of the list content.
				I can easily find the most frequently used menu items in the first few positions of the menu.
				The items numbering starts with 'one'.
				Bullet lists present items of equal status or value.
				The first letter of only the first word of a list item is capitalized.
Navigation	4.92	1.23	0.97	Navigation options are available in all pages.
				Navigation items can be easily differentiated.
				Long pages contain links that take me to the corresponding content farther down the page.
				I can easily tell my location.
				Primary navigation menus are located in the left panel.
				Secondary and tertiary navigation menus are placed together.
				Tab labels are clearly descriptive of their function.
				Navigation tabs are located at the top of the page.
				Navigation tabs look like clickable versions of real-world tabs.
				Navigation-only pages contain no more than one screen of information.
				Uses 'sequential' menus for simple forward-moving tasks.
				Uses 'simultaneous' menus for tasks that require numerous uses of the Back button.
				Provides a site map.
				I can tell the nature of the page content behind a link prior to clicking on it.
				Navigation techniques allow me to keep track of my location.
Page layout	4.96	1.24	0.97	The pages are not cluttered.
				Important, clickable items are placed consistently.
				Most important items are placed at the top center of pages.
				I can compare elements of information in tables or forms without having to remember one while going to another page.
				I can easily find the most important information.
				Pages are not too crowded with items or information.
				Elements (e.g., text blocks, row, columns) are consistently aligned across all pages.
				The layout automatically adjusts to my monitor resolution settings.
				I can easily tell when I reach the bottom or top of the page.
				The page layout clearly indicates that there is more content.
				Uses the appropriate amount of white space on pages that are used for scanning and searching.
				Uses short line lengths (about 50 characters per line).
				Uses longer line lengths (about 75–100 characters per line).
				Uses simultaneous menu (i.e., functional items in one frame and the items that are being acted upon in another frame).
Screen	4.94	1.31	0.98	I can easily distinguish between required and optional data entry fields.
				The labels of pushbuttons clearly indicate the action that will be applied when the pushbutton is clicked.
				Data entry labels use consistent wording throughout.
				I can enter codes (e.g., application numbers, receipt numbers) easily without worrying about changing to uppercase of lowercase letters.
				The labels of data fields help me understand what entries are desired.
				I do not have to enter the same information more than once.
				The labels are close enough to their associated data entry fields.
				I can easily see my entered data without scrolling.
				The use of radio buttons is appropriate.
				The use of embedded programs such as slideshows, blogs, and social networking is appropriate.
				Detects my errors.
				I can get helpful suggestions to correct my errors.
				The length of data entry and data display sections is appropriate.
				I can easily enter phone and social security numbers.
				I can easily enter my data without dealing with different input methods.
				I can easily spot the buttons or items that I need to select.
				I can easily select multiple items from a list when I need to make several selections.
				Uses clear measurement units (e.g., minutes, ounces, inches).
				I can easily find items within a list without scrolling too much.
				Uses appropriate values to speed my data entry.

(continued on next page)

Table A2 *(continued)*

Construct	Mean	SDev	Cron. α	Item
				The cursor is automatically placed at the beginning of the first data entry field within a data entry form.
				I can easily click on links without getting confusing results.
				Uses appropriate lists.
				Text entry fields are appropriate.
				The data entry form offers the 'None' option if none of the items in a question is applicable.
				I can easily move between data fields.
				I do not need to use the 'shift' key a lot.
Scrolling and paging	4.94	1.33	0.92	The layout eliminates the need to scroll horizontally.
				I can scroll fast throughout the pages.
				Uses longer, scrolling pages to enable reading for comprehension.
				I can easily move between pages without having to scroll to find important information.
				Pages are short and well-organized.
Search	4.79	1.35	0.96	The search capability provides precise information.
				Guidelines on searchable content are available.
				I can get precise results from the search capability whether I use lowercase or uppercase letters.
				Each page of rich content has a standard search option.
				The search engine recognizes my search terms.
				The search engine is easy to use.
				I can easily find the different search capabilities.
				I can easily use the different search capabilities.
				Helpful hints are used to support my search.
				Keywords are used to help me select my search terms.
Text	5.12	1.23	0.95	Black text is used on a plain, high-contrast, non-patterned background.
				The formatting of items is consistent from one page to another.
				The use of capitalization is appropriate.
				Elements are visually consistent within and between pages.
				The use of bold text is appropriate.
				The use of attention-attracting features (e.g., brightly-colored items, moving and animated objects, images) is appropriate.
				Fonts are familiar to me.
				Fonts' sizes are appropriate.
				Color-coding schemes are easily understood.
				Important content is emphasized.
User experience	4.89	1.27	0.98	Does not display unsolicited windows.
				Provides a section on useful frequently asked questions and answers.
				Presents referenced articles/studies with citations and references.
				Displays author's credentials.
				Looks professionally designed.
				Provides an archive of past content.
				I was able to connect to outside sources and materials.
				Provides links to credible sites.
				I was able to perform tasks in the same sequence across similar situations.
				Performs difficult functions on my behalf so that I can focus on other tasks.
				I do not have to remember a lot of information from one place to another.
				Pages do not take too long to load.
				Informs me when a page is programmed to 'time out'.
				Presents information/data in a usable format.
				I have the option to read online or print information in a usable format.
				Provides appropriate feedback while waiting (e.g., hourglass to indicate status).
				Presents pages with widths that print properly.
				I do not have to remember information from a previous page while browsing.
				Design features are familiar to me.
				Help section gives enough context to understand the terms used.
				I have the option to download and print documents.
				As a new user, I was able to access information about the content easily.
Intention to use	3.70	2.07	0.97	I intend to use the website in the next < n > months.
				I predict I would use the website in the next < n > months.
				I plan to use the website in the next < n > months.
Citizen satisfaction	4.07	0.80	0.86	I am satisfied with my use of the website to access government healthcare insurance services.
				I am frustrated with my interaction with the website[a].
				I am content with my experience with the website.
Usability	4.64	1.13	NA	I think that I would like to use this system frequently.
				I found the system unnecessarily complex[a].
				I thought the system was easy to use.
				I think that I would need the support of a technical person to be able to use this system[a].
				I found the various functions in this system were well integrated.
				I thought there was too much inconsistency in this system[a].
				I would imagine that most people would learn to use this system very quickly.
				I found the system very cumbersome to use[a].
				I felt very confident using the system.
				I needed to learn a lot of things before I could get going with this system[a].

[a] Indicates a reverse-coded item.

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