Alternate Endings – A Tale of Two Surveys and Priming, Order Effect, and Other Biases

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ABSTRACT

The authors conducted two surveys in 2014 on consumer awareness of and willingness to purchase home automation systems with a representative sample of the US population. The surveys presented home automation systems to the respondents as a technology solution that could include broad services spanning home security, home energy management, information, communication, and entertainment among others. This paper will present findings from the two surveys as a classic case study on survey design methodology. The paper contributes to the conversation about survey design and the potential implicit and explicit biases, and explores questions regarding reasons for differential change in responses, the questions to consider when evaluating a questionnaire for lurking biases, and potential mitigation strategies to avoid/manage these biases. This paper will provide empirical evidence of survey measurement biases due to the order effect and priming among others. Findings from this paper are pertinent to researchers/evaluators, program managers, and others looking to further the discussion on methodological considerations when conducting primary research on topics important to the utility of the future.

Introduction

The authors conducted two surveys in 2014 on consumer awareness of and willingness to purchase home automation systems with a representative sample of the US population. The surveys presented home automation systems to the respondents as a technology solution that could include broad services spanning home security, home energy management, information, communication, and entertainment among others.

This paper will present findings from the two surveys as a classic case study on survey design methodology that illustrates the implicit and explicit biases in surveys. Findings from both surveys are valid, but key inferences differ, widely underscoring the importance of contextualizing research findings that will be used as inputs to decision-making in a rapidly expanding market for new technology.

Data Sources

The Consumer Pulse Home Automation Systems Surveys were conducted 2014 amongst members of a non-probability opt-in national consumer web panel. Respondents were incentivized to complete surveys with a nominal donation to a charitable institution of their choice. While this encourages respondents to complete surveys, it serves to minimize professional survey takers who rush through a survey for financial incentives (Hillygus, Jackson, & Young, 2014). The samples for these surveys were designed to be representative of the online population along demographic lines such as gender, education, region, ethnicity, and income. The samples for the two surveys were drawn independently from a consumer web panel. A threshold of 300 seconds completion time was applied as a data quality filter to arrive at the final sets of usable completes, as summarized below (Table 1).

Table 1: Summary of Data Sources

Consumer Pulse Home Automation Systems Surveys	**Survey 1**	**Survey 2**
Completed in	July 2014	September 2014
Total Responses	1201	640
Usable Completes (completion time of over 300 seconds)	957	454

Differential Impact on Responses

The surveys were largely similar in terms of the topics covered and included questions on the following key topics:

- Awareness of home automation systems
- Interest in home automation systems
- Features desired in home automation systems
- Price willing to pay for purchase of home automation systems and subscription to associated services
- Likelihood to purchase
- Impact of utility endorsement on likelihood to purchase
- Current penetration of technologies, products and services such as Smart TV, backup generators, electric vehicles, solar panels, cable television etc.
- Purchase and subscription channels
- Purchase, installation, and support process
- Use of a programmable thermostat
- Use of a home security system

The surveys differed with respect to the placement of questions on use of a programmable thermostat and home security system, and the visual and accompanying text used to describe a home automation system. The questions listed above and the associated response options stayed the same between the two surveys. We will show that while in some cases, these changes in order and accompanying text did not affect the survey responses, they resulted in significantly different results in some others.

No discernible impact on responses

Awareness of terms related to home automation systems, interest in the product, and likelihood to purchase are amongst the many questions to which responses were similar in both Surveys 1 and 2. Table 2 shows that awareness of home automation systems and related terms does not depend on the question's order of appearance. On Survey 1, respondents encounter the first question related to home automation systems at Question 9 after answering questions related to their use of different technologies, programmable thermostats, and home security systems. On Survey 2, the question related to home automation systems was presented as Question 1 (Question 9 on Survey 1). The difference in responses to this question between Surveys 1 and 2 is minimal to none.

Table 2: Awareness of home automation systems and related terms

Which of the terms have you heard of? Check all that apply.	**Survey 1, n=957, Question 9**	**Survey 2, n=454, Question 1**
Home Automation Systems	50%*	42%
Internet of Things	15%	15%
Home Energy Management	42%	37%
Smart Home	63%	66%
Smart Appliances	72%	72%
Smart Grid	27%	29%
Connected Home	24%	23%

Different visuals and accompanying text explaining home automation features did not affect respondents' interest in home automation systems. Respondents in both surveys are asked about their interest in home automation systems after being shown a visual and reading an accompanying description of the features offered by such a system. Although the visuals and the accompanying text were different in Surveys 1 and 2 and immediately preceded the question on interest in home automation systems, the proportion of those saying they were extremely or very interested in a home automation system are comparable (Table 3).

Table 3: Interest in home automation systems (% 4, 5 on a 1-5 scale)

How interested would you be in such a product/service?	**Survey 1, n=957, Question 11**	**Survey 2, n=454, Question 2**
Interest in home automation systems	23%	24%

Survey 1 then asks respondents to indicate the features they desire in such a product and the amount they would be willing to pay for purchase and installation and monthly subscription fees for a home automation system before asking them about their likelihood of purchasing a home automation system with the features they desire. Survey 2 has the same sequence of questions and also includes questions on purchase and subscription channels, installation and support processes preferred, before asking respondents to indicate their likelihood of purchase. As shown in Table 4 below, those saying they definitely or probably would purchase a home automation system is comparable.

Table 4: Likelihood of purchasing a home automation system (% 4, 5 on a 1-5 scale)

How likely would you be to purchase a Home Automation System with the features you indicate above for your home?	**Survey 1, n=957, Question 15**	**Survey 2, n=454, Question 14**
Likelihood of purchasing a home automation system	17%	17%

Introduction of parameters such as installation, purchase and subscription channels into the respondent's consideration prior to the asking about likelihood of purchase in Survey 2 does not result in a significant difference from Survey 1. The order or halo effect for responses to the above questions is seen to be minimal to none.

Significant impact on responses – Priming, Order, and Visual cues

Apart from a changed order in the appearance of questions, an additional point of difference in Surveys 1 and 2 was the use of different graphics and accompanying text to describe the features of a home automation system. In Survey 1, this text and graphic (Figure 1) occurs after Question 9 which probes respondents on awareness of home automation systems and related terms. The text accompanying the graphic in Survey 1 mostly describes features related to energy and home security, but the icons in the graphic indicate a broader suite of features related to communication, irrigation, and entertainment, in addition to energy and home security. The graphic and accompanying text in Survey 2 indicates a broad offering and explicitly calls out features beyond just energy and security (Figure 2).

A Home Automation System lets you control your heating and cooling, appliances, lighting, security monitoring and/or control of gates, doors, windows, and/or other systems in your home, to provide improved convenience, comfort, energy efficiency and security. There are several offerings and configurations available in the market that can do some or all of these things.

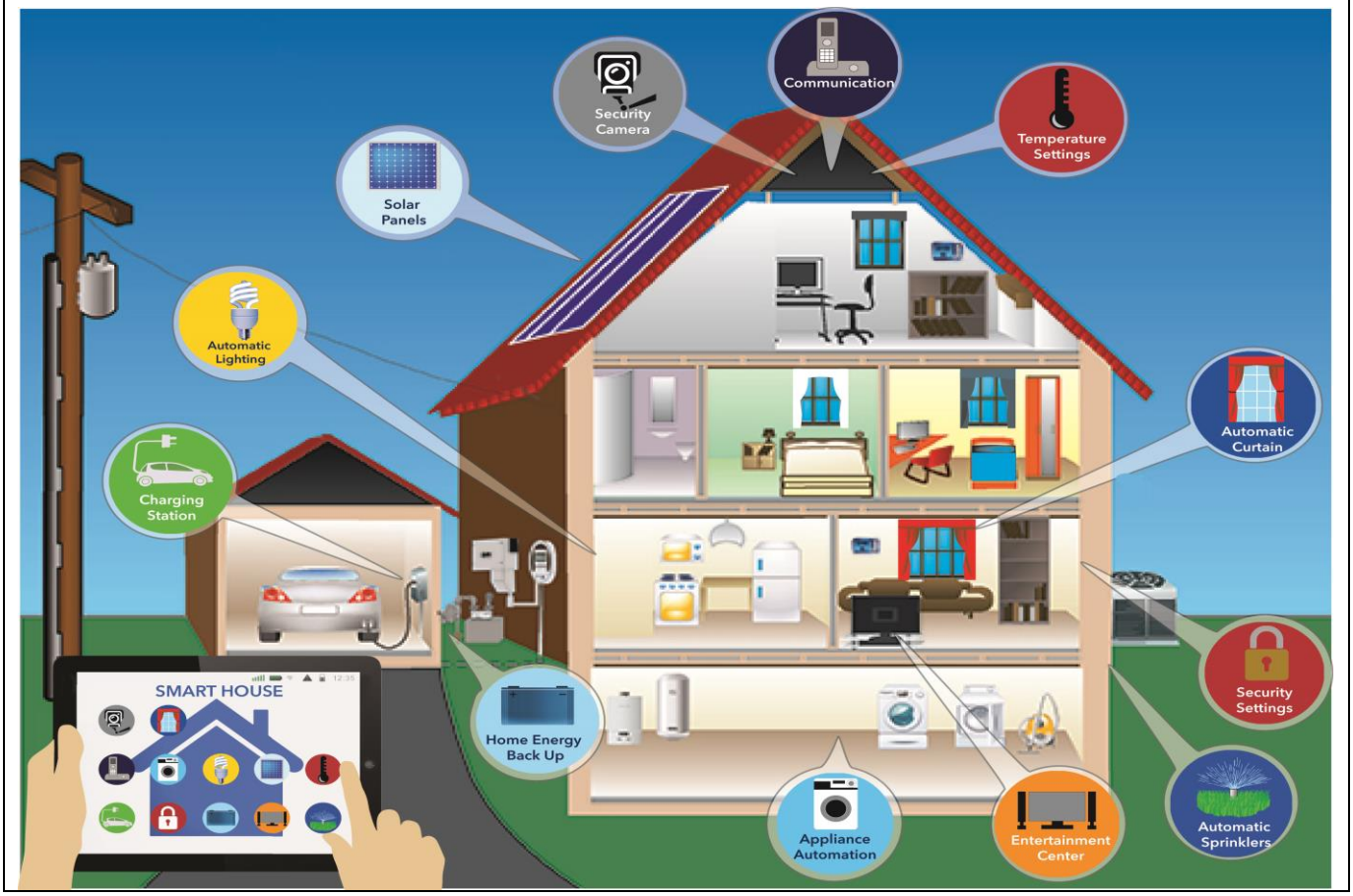

Figure 1: Description and visual of a home automation system in Survey 1

A Home Automation System offers customers a single unified solution to automate and control various aspects of their homes to provide improved convenience, comfort, efficiency, and security.

The following are examples of some of the features offered by such systems:

Entertainment - whole house audio for music, home theater with surround sound, ability to stream web video content from sites like YouTube, Netflix etc.

Information - "virtual personal assistant" to obtain news headlines, weather reports, sports scores, keep track of your appointments, routine home and car maintenance schedules etc.

"Telecare" - reminders to take medication, track doctor's appointments, remote health monitoring, and medical alerts for seniors or other vulnerable members of the family

Communications - whole house intercom, wi-fi, email, telephone etc.

Lighting - one touch settings to automate lighting intensity by type of use such as brighter lights for working or cooking, auto blind/curtain and dimmer lights when watching a movie, set on/off schedules for security, dawn/dusk automation etc.

Indoor climate control - control heating and cooling schedules based on time of day, month of year and annual including season change, temperature and humidity.

Security - remotely monitor and/or control doors, windows, blinds etc,.one touch settings to activate motion sensors and security cameras, turn on/off interior/exterior lights as desired, close blinds, and automatically lock all the doors when away, emergency notifications etc,

Energy management - monitor energy usage from appliances to heating and lighting at home or remotely, automate usage to take advantage of lower prices for energy at certain times or avoid times with high energy prices etc.

There are several offerings and configurations available in the market that can do some or all of these things.

Figure 2: Description and visual of a home automation system in Survey 2

The impact of this changed visual and accompanying text cumulated with changes in the order of questions is seen in responses to questions regarding preferred purchase channel (Figure 3). While the question text and response options are exactly the same when probing respondents about their preferred purchase channel for a home automation system, the visual and questions preceding this question are different in both surveys. Additionally, these complex images could have varied interpretations of the meanings they may potentially convey (Couper, Conrad, & Tourangeau, 2007). Note that Survey 1 had a visual that indicated a broad suite of features but accompanying text that focused on energy and home security. Survey 1 also had modules with two to four questions each on programmable thermostats and home security that preceded any questions related to home automation systems, potentially priming respondents to have energy and security top of mind.

One in four respondents (25%) indicated that their preferred purchase channel for such a system would be their energy utility and nearly the same number indicated that home security would be their choice in Survey 1. In Survey 2, while home security is the preferred channel for a comparable proportion, those who would prefer to purchase a home automation system from the utility falls significantly to 8%. While dominant home security firms have already gone to market with bundled home automation systems that offer thermostat, appliance, and lighting controls, there are fewer to no examples of utilities that bundle energy with security and other features. This could explain why respondents were more inclined towards other providers for an integrated offering that was not presented with energy dominant features.

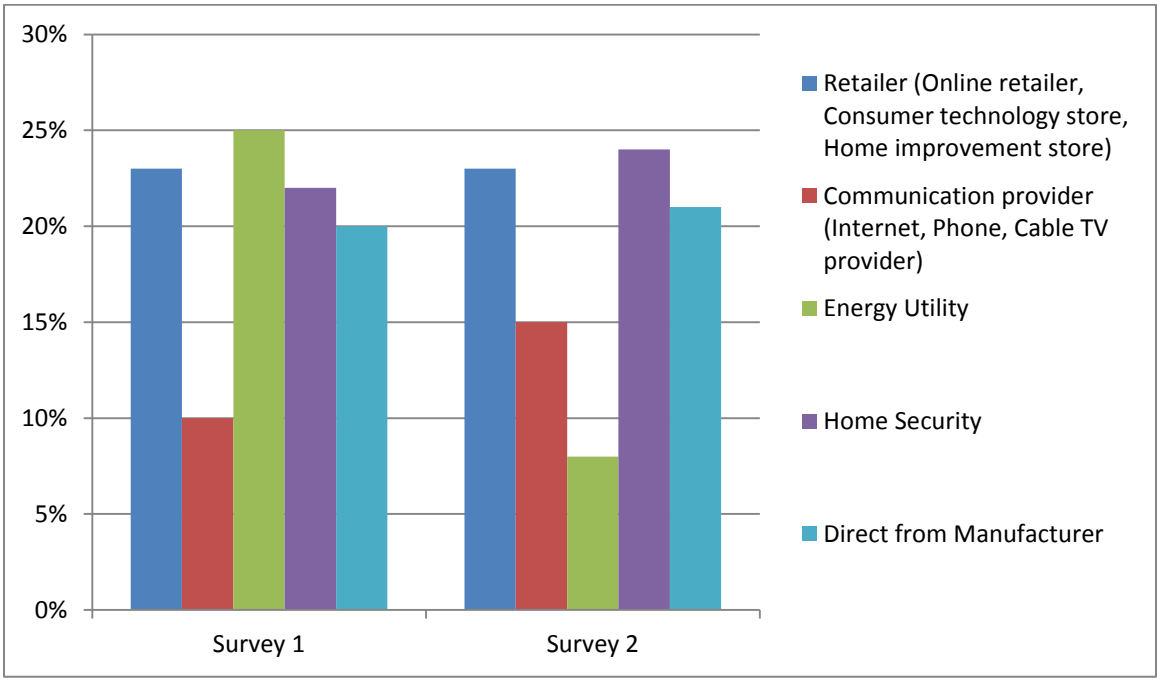

Figure 3: Preferred purchase channel for home automation systems

A similar effect is observed on the question that asks respondents to indicate from whom they would like to subscribe to services associated with home automation systems, with a significant drop in utilities as a preferred service provider: from 27% in Survey 1 to 6% in Survey 2 (Figure 4). A corresponding rise is observed in those who would like to subscribe to associated services separately from their current communication/energy/home security provider from 40% in Survey 1 to 58% in Survey 2.

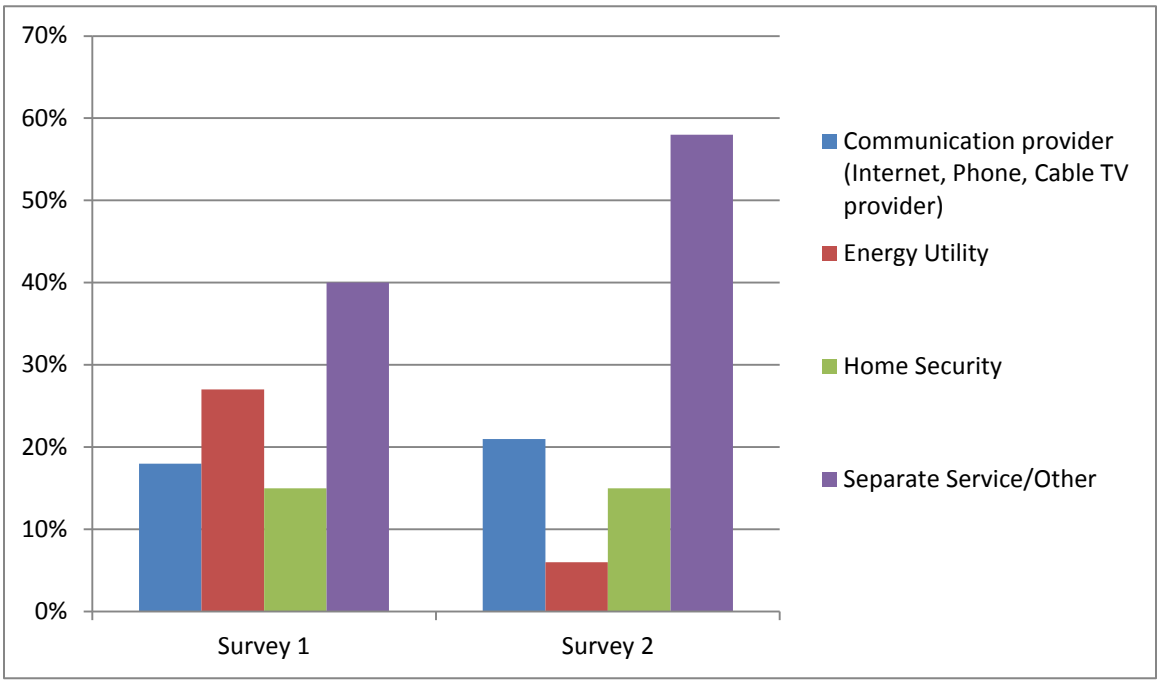

Figure 4: Preferred subscription channel for home automation systems services

Respondents were asked to indicate the impact of a utility endorsement on their likelihood to purchase and this shows a significant difference between Surveys 1 and 2 (Table 5). While the text and response options for this question were the same in both Surveys 1 and 2, the responses were impacted by respondents' understanding of the role of the utility in the market for such a product. It could be hypothesized that respondents' perception of the technology as less focused on energy and as a broader integrated offering results in reduced mindshare for the utilities.

Table 5: Impact of utility endorsement on likelihood to purchase home automation systems

Impact of utility endorsement on likelihood to purchase home automation system	**Survey 1, n=957, Questions 16, 18**	**Survey 2, n=454, Questions 15, 17**
More likely to purchase	37%*	26%
No impact on purchase decision	55%*	63%
Less likely to purchase	9%	11%

Conclusions

We observe that priming and order/halo effect can have a significant impact on survey responses in some but not all cases. The effects are manifested only on questions that are directly impacted by the substance of the change. Visuals are an excellent addition to web surveys and convey a lot of rich information, but potentially lend themselves to variable interpretations. If the objective of inclusion of visuals is to clarify a concept, using accompanying text with clear descriptions in addition to the visuals is recommended. We note that Survey 1 primed respondents towards energy and home

security with questions on programmable thermostats and home security systems preceding all questions related to home automation systems. The halo effect of this ordering of questions was confounded with descriptions for visuals that added to the increased focus on energy and security.

For the authors, findings from both surveys were remarkably insightful and valid. The traditional "wires to the home" providers such as energy and home security are poised to make a play in the rapidly expanding home automation systems market. Findings from Survey 1 may be mapped to a more near- term market scenario which is dominated by these traditional providers. The research indicates that customers indicate a preference for an integrated solution rather than several stand-alone services. With non-traditional players from other industries, such as Google, Apple, Samsung etc., making a play in the home automation systems market, the findings from Survey 2 are informative and map to a more competitive longer-term scenario as this market matures.

References

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