

Effect of display design and number of follow-up questions on accuracy of survey responses

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Disclosure avoidance IP number: A.19-26

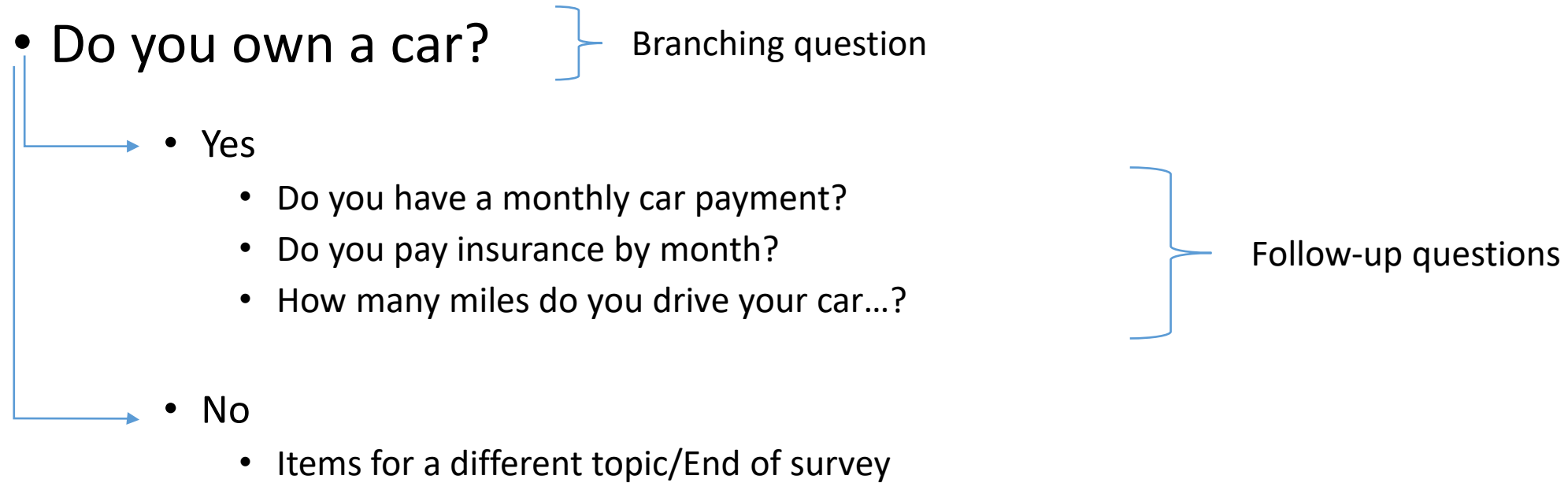
Background

- Branching question: selection of a specific answer to this question may lead to additional topic-related items.
- Follow-up question: Items that are presented if a specific response to the branching question is provided.

Background: Example of branching question

- Do you own a car?
 - Yes
 - Do you have a monthly car payment?
 - Do you pay insurance by month?
 - How many miles do you drive your car...?
 - No
 - Items for a different topic/End of survey

Background: Example of branching question



Display design and number of follow-up questions

- Some popular designs to display follow-up questions in a survey include:
 - Next page design
 - Grayed-out design
 - Unfolding design
- It is possible that different ways to present the follow-up questions may lead to different rates of response accuracy.
- Higher number of follow-up questions may lead to decrease in response accuracy

Research Question

- Which combination of display design and number of follow-up questions provides higher levels of accuracy in responses?

Methodology

Methodology: Sample characteristics

- Participants were recruited through a national non-probability online panel (Census Bureau Research Panel)
- Time to complete full survey ~7min
- Time to complete task of interest: ~ 3 minutes
- n = 13,959
- Age: Mean = 54.83 (Range: 19 – 98)
- Sex
 - Female: 52.3% (7307)
 - Male: 47.4% (6615)
 - NA: 0.3% (37)

Education	%
Less than High School	4
High School	8
Some college	17
Associate's	8.8
Bachelor's	31.9
Graduate degree	33.8
NA	0.1
Race	%
White	87.9
Hispanic or Latino	4.8
Black or African American	5.4
American Indian or Alaskan Native	2.3
Native Hawaiian or Pacific Islander	0.4
Middle Eastern or North African	0.9
Asian	3.4

Device Used

Device	n	%
Laptop or desktop	5570	39.9
Phone	7496	53.7
Tablet	864	6.2
NA	29	.2

Experimental design

- 3 x 3 Between-subjects design. 9 Experimental conditions.
- Display design
 - Next page
 - Grayed-out
 - Unfolding
- Number of follow-up questions
 - 3
 - 5
 - 7

Materials: Branching question

Do you have more than one appliance in your home?

For example: washing machine, refrigerator, dishwasher, crockpot, coffee maker, toaster, vacuum

☐ Yes

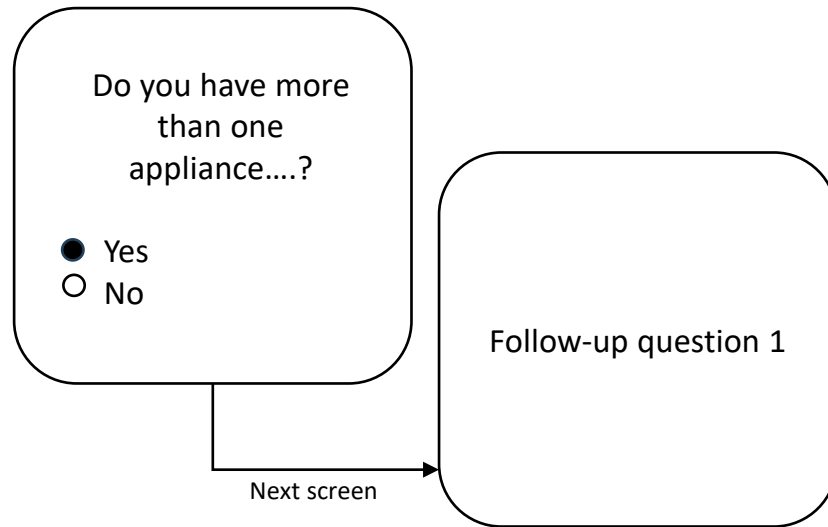
☐ No

Display Designs: Next page design

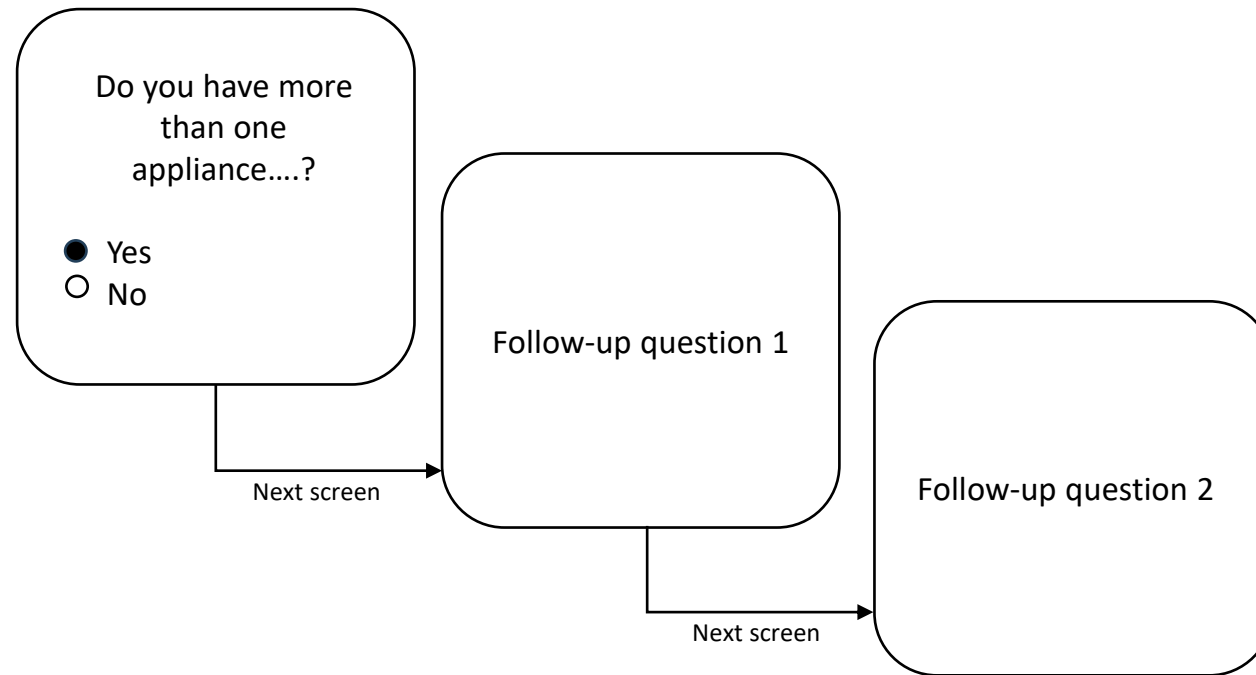
Do you have more
than one
appliance....?

- ☒ Yes
- ☐ No

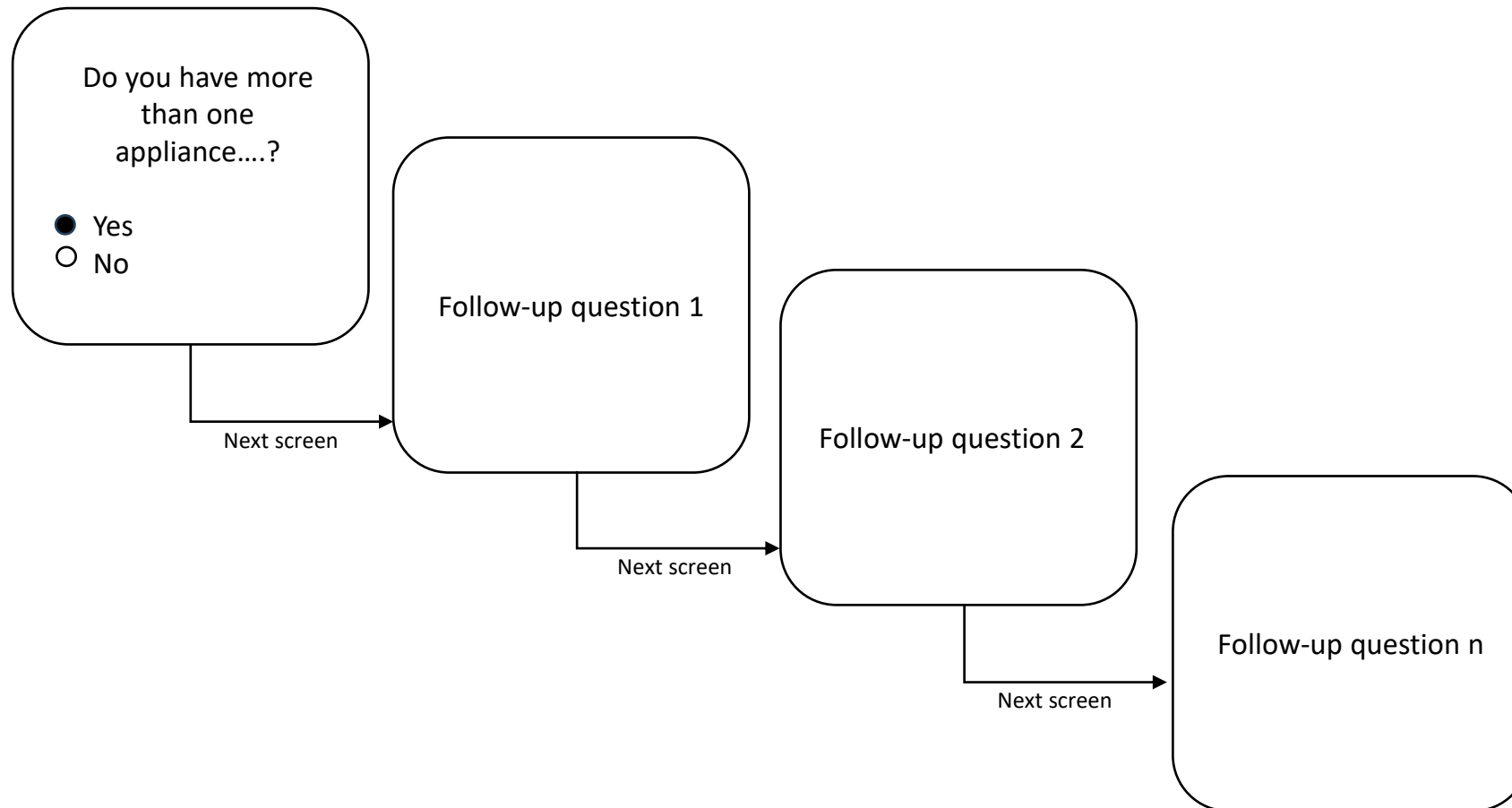
Display Designs: Next page design



Display Designs: Next page design



Display Designs: Next page design



Display Designs: Grayed-out design

Do you have more than one appliance in your home?

- ☐ Yes
- ☐ No

Follow-up question 1

Follow-up question 2

Follow-up question 3

Follow-up question 4

Follow-up question 5

Follow-up question 6

Follow-up question 7

Display Designs: Grayed-out design

Do you have more than one appliance in your home?

- ☐ Yes
- ☐ No

Follow-up question 1

Follow-up question 2

Follow-up question 3

Follow-up question 4

Follow-up question 5

Follow-up question 6

Follow-up question 7

Next screen

Do you have more than one appliance in your home?

- ☒ Yes
- ☐ No

Follow-up question 1

Follow-up question 2

Follow-up question 3

Follow-up question 4

Follow-up question 5

Follow-up question 6

Follow-up question 7

Display Designs: Unfold design

Do you have more than one appliance in your home?

- ☐ Yes
- ☐ No

Display Designs: Unfold design

Do you have more than one appliance in your home?

- ☐ Yes
- ☐ No

Next screen

Do you have more than one appliance in your home?

- ☒ Yes
- ☐ No

Follow-up question 1

Follow-up question 2

Follow-up question 3

Follow-up question 4

Follow-up question 5

Follow-up question 6

Follow-up question 7

Materials: 3 Follow-up questions

1. How many appliances do you have at home?
2. How many of your appliances are mainly used in the kitchen?
3. How many of your appliances are mainly used outside of the kitchen?
4. How many of your appliances use electricity?
5. Is your stove/range/cooktop electric or gas-operated?
6. How many small appliances do you have at home? *(for example: blender, mixer, toaster)*
7. How many large appliances do you have at home? *(for example: refrigerator, washer, dryer)*

Materials: 5 Follow-up questions

1. How many appliances do you have at home?
2. How many of your appliances are mainly used in the kitchen?
3. How many of your appliances are mainly used outside of the kitchen?
4. How many of your appliances use electricity?
5. Is your stove/range/cooktop electric or gas-operated?
6. How many small appliances do you have at home? *(for example: blender, mixer, toaster)*
7. How many large appliances do you have at home? *(for example: refrigerator, washer, dryer)*

Materials: 7 Follow-up questions

1. How many appliances do you have at home?
2. How many of your appliances are mainly used in the kitchen?
3. How many of your appliances are mainly used outside of the kitchen?
4. How many of your appliances use electricity?
5. Is your stove/range/cooktop electric or gas-operated?
6. How many small appliances do you have at home? *(for example: blender, mixer, toaster)*
7. How many large appliances do you have at home? *(for example: refrigerator, washer, dryer)*

Outcomes of interest

- Accuracy for the branching question
 - Responding “Yes” to the branching question
 - Do you have more than one appliance in your home?
- Accuracy for the follow-up questions
 - Item 1 = (Item 6 + Item 7)
 - 1. How many appliances do you have at home?
 - 6. How many small appliances do you have at home?
 - 7. How many large appliances do you have at home?

Hypotheses: Accuracy of the branching question

- **H1 Validity of the branching question:** If respondents attempt to answer survey questions truthfully, the proportion of respondents who answer “Yes” to the branching question will be higher than the proportion of respondents who answer “No”.
 - Yes > No
- **H2 Effect of display design:** If seeing the number of follow-up questions leads respondents to engage in burden-reducing strategies (inaccurate response), then the accuracy for the branching question will be higher in the “next page” than in the “grayed-out” and “unfolding” conditions.
 - Next page > Grayed out and Unfolding designs
- **H3 Effect of number of follow-up questions:** If higher number of questions leads respondents to engage in burden-reducing strategies (inaccurate response to branching question), then the “3 follow-up questions” condition will result in higher accuracy than the “5 follow-up question” and “7 follow-up questions” conditions.
 - 3 > 5 > 7

Hypotheses: Accuracy of the follow-up questions

- **H4 Effect of display design:** If seeing the number of follow-up questions leads respondents to engage in burden-reducing strategies (inaccurate response), then the accuracy for the follow-up questions will be higher in the “next page” than in the “grayed-out” and “unfolding” conditions.
 - Next page > Grayed out and Unfolding designs
- **H5 Effect of number of follow-up questions:** If higher number of questions leads respondents to engage in burden-reducing strategies (inaccurate responses), then the “3 follow-up questions” condition will result in higher accuracy than the “5 follow-up question” and 7 follow-up questions” conditions.
 - $3 > 5 > 7$

Results: Accuracy of the branching question

Hypotheses 1, 2, and 3

H1: Accuracy of the Branching Question

Yes > No

- Do you have more than one appliance in your home? *For example: washing machine, refrigerator, dishwasher, crockpot, coffee maker, toaster, vacuum.*
- Yes: 99.2% (n = 13,841)
- No: 0.8% (n = 118)
- $B = 4.76$, $se = .09$, $z = 51.54$, $Exp(B) = 117.30$, $p < .001$.
- **H1 Supported:** Most participants provided an answer that is likely to be true.

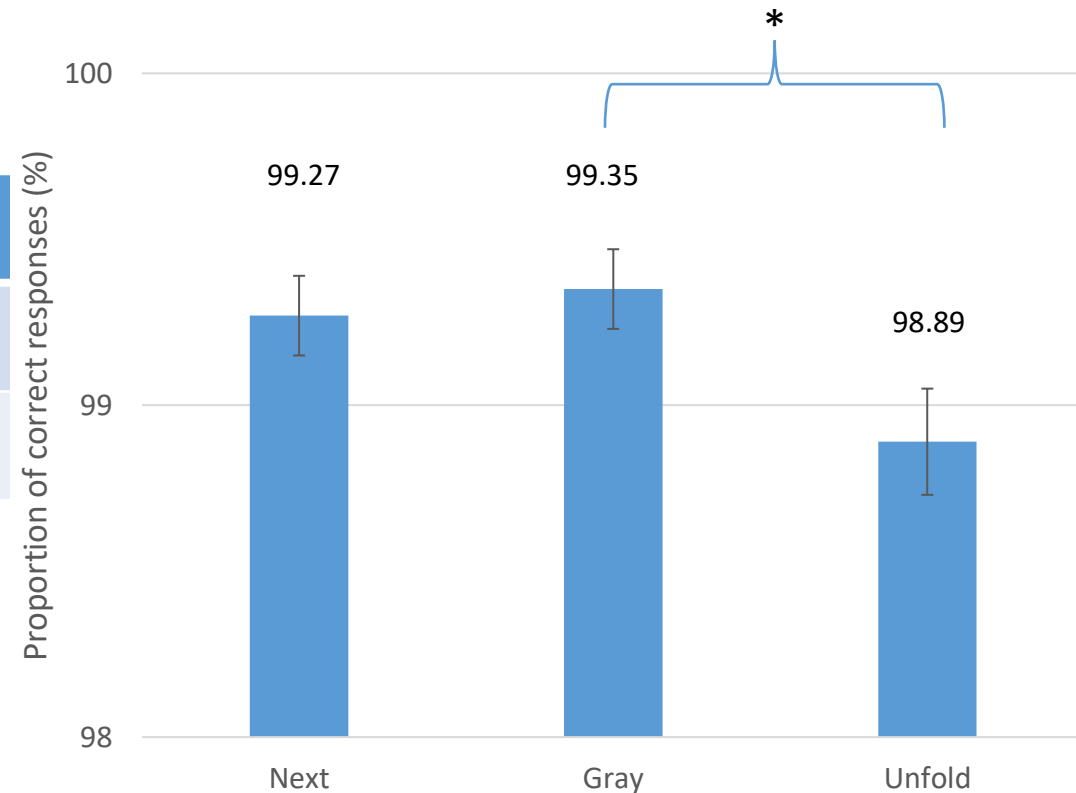
Accuracy of the Branching Question

H2: Effect of Display Design

H2: Next page > Grayed-out and unfolding

Contrast	Estimate	sd	z	p	Exp(B)	% change
Unfold-Next	0.47	0.22	2.14	.03	1.6	60.2%
Unfold-Gray	0.58	0.23	2.58	.009	1.8	79.5%

- **H2 Not supported:** “Next page” design led to higher accuracy than “unfolding” design, but not after Bonferroni correction. Grayed-out design showed higher accuracy than “unfolding” design.



Data source: U.S. Census Bureau Affinity Panel

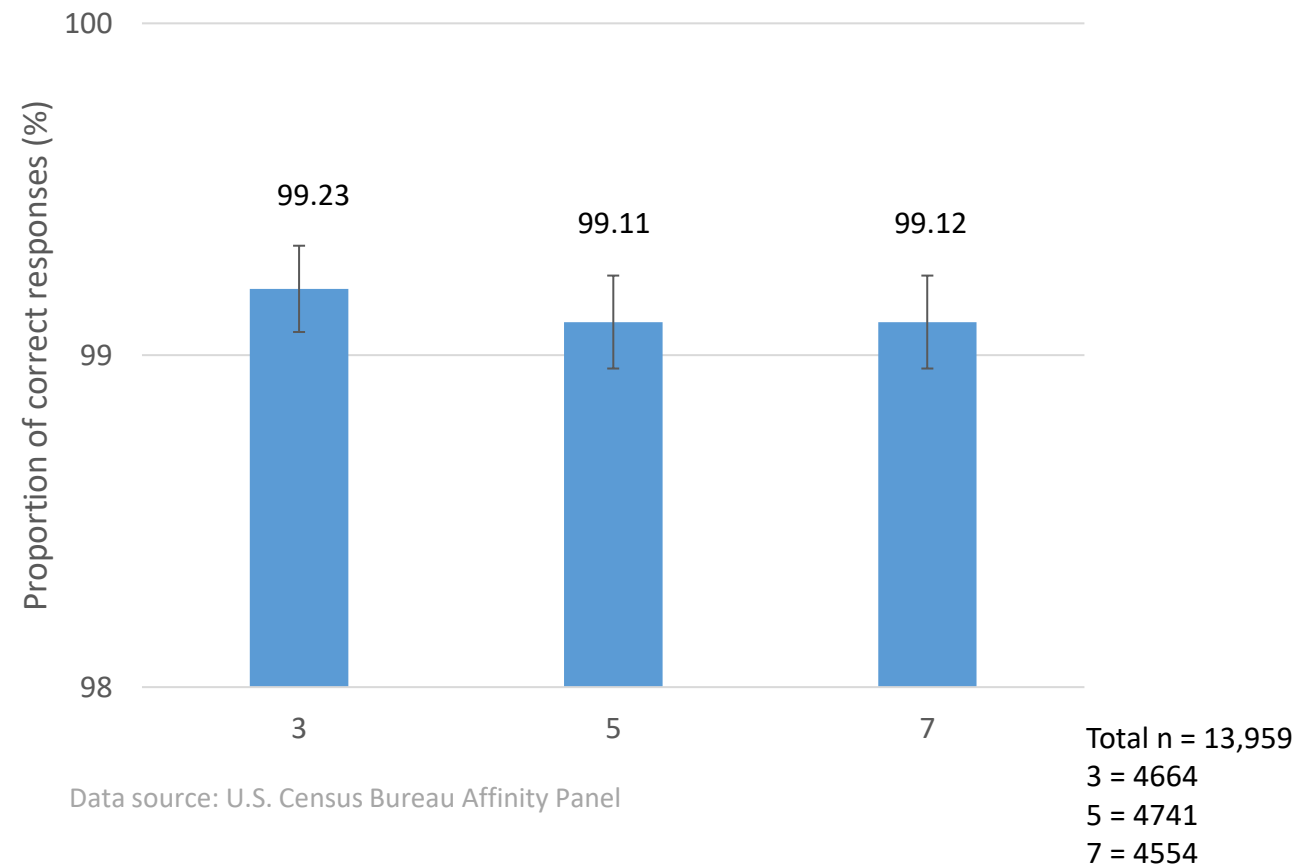
Total n = 13,959
Next = 4657
Gray = 4752
Unfold = 4550

Accuracy of the Branching Question

H3: Effect of Number of follow-up questions

H3: 3 > 5 > 7

- **H3 Not supported:** No statistically significant difference in accuracy across the levels of follow-up questions.



Results: Accuracy of the follow-up questions

Hypotheses 4 and 5

Dropped “Gray 7” and “Branching question: No”

- Programmer’s error:
 - Data for last question in “Gray-7” condition was not recorded.
 - Removed Gray-7 (n = 1541)
- Removed data for branching question = “No” (n = 118)
- New n = 12300

GLM Accuracy ~ Age + Sex + Race + Education + Device

- Sex and Race not statistically significant.
- Higher age = lower likelihood of accuracy.
- Higher education = higher likelihood of accuracy.
- Device:
 - Laptop higher likelihood of accuracy than phone or tablet.

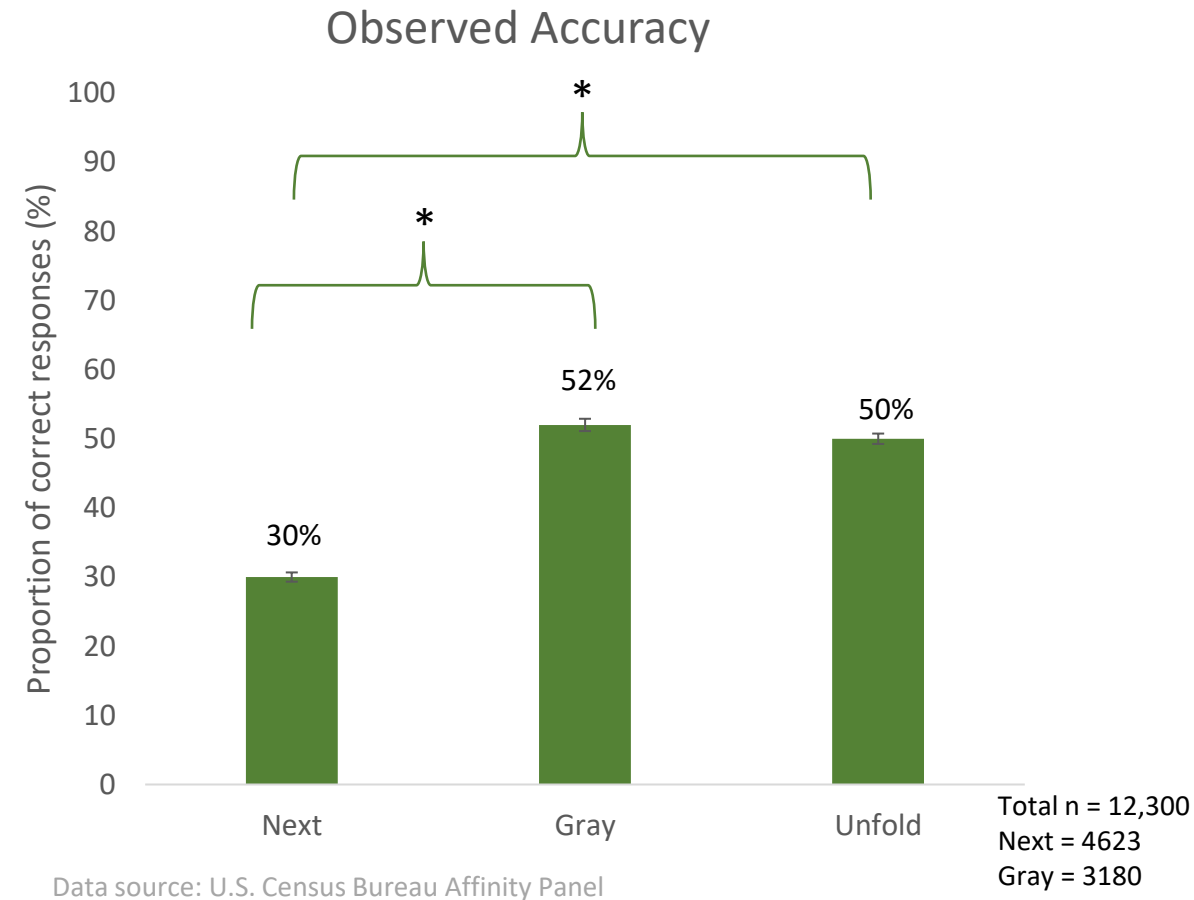
Accuracy of follow-up questions

H4: Effect of Display Design

H4: Next page > Grayed-out and unfolding

Variable	Estimate	Se	z	p	Exp(B)	% change
Next-Gray	0.96	0.05	19.7	<.001	2.63	163%
Next-Unfold	0.89	0.04	19.9	<.001	2.44	144%

H4 Not supported: “Next page” condition showed lower accuracy than both “grayed-out” and “unfolding” conditions



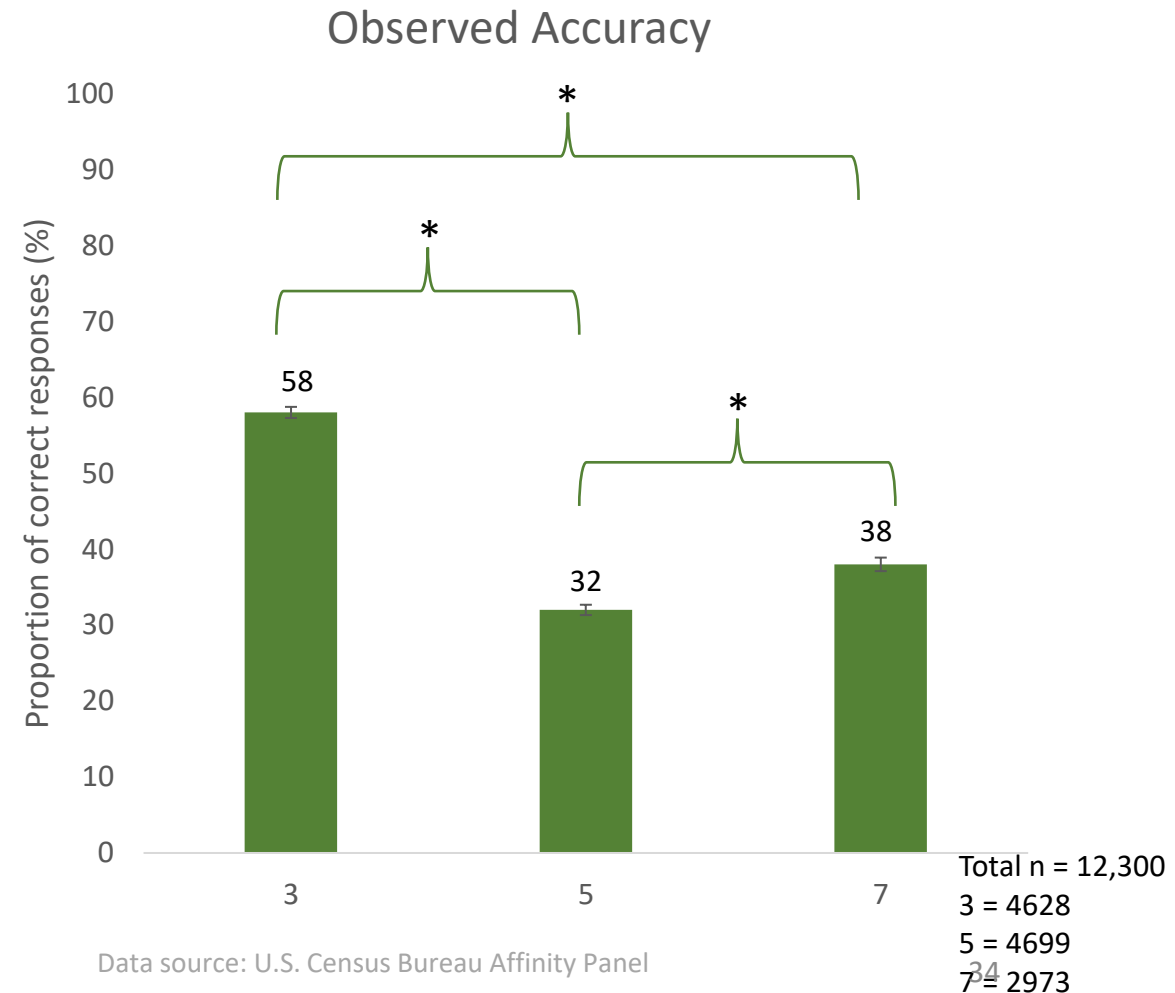
Accuracy of follow-up questions

H5: Number of follow-up questions

H5: $3 > 5 > 7$

Variable	Estimate	se	z	p	Exp(B)	% change
3-5	-1.10	0.04	-24.9	<.001	0.33	-67%
3-7	-0.85	0.05	-17.2	<.001	0.43	-57%
5-7	0.25	0.05	5.1	<.001	1.3	29%

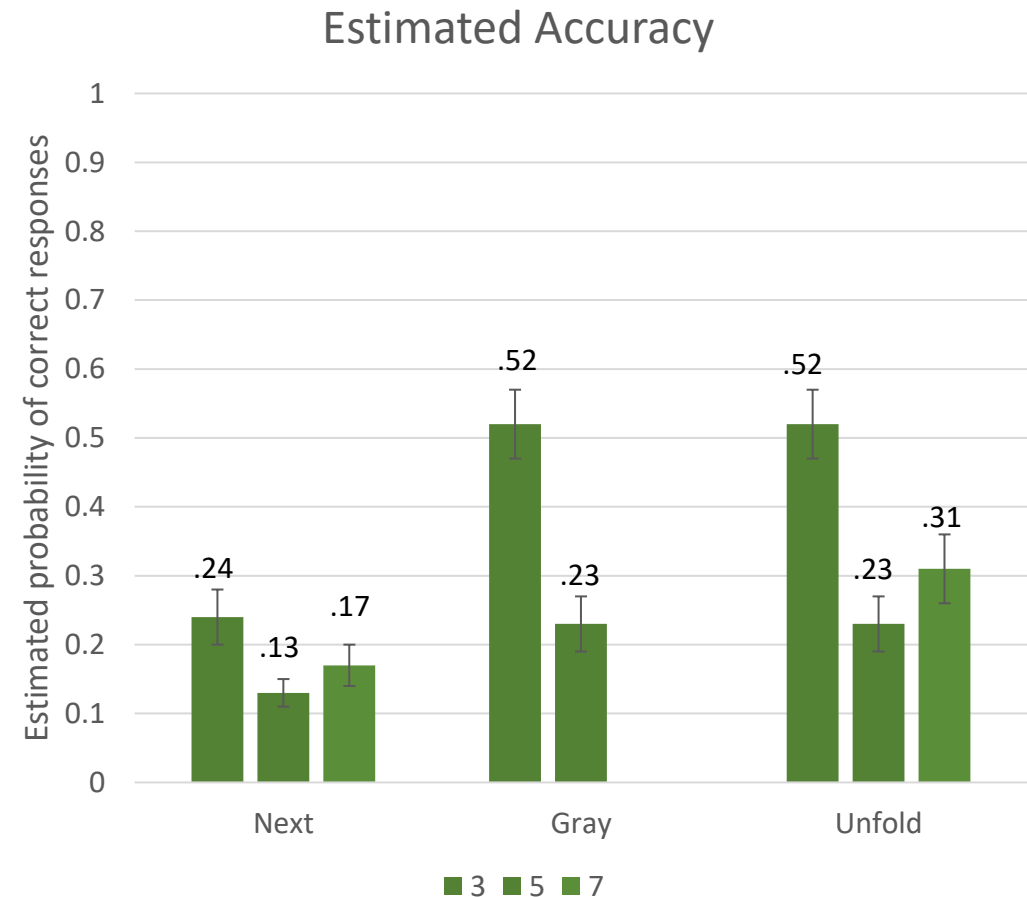
H5 Partially supported: “3 follow-up questions” condition showed higher accuracy than 5 and 7 follow-up questions, but 7 questions had higher accuracy than 5 follow-up questions condition.



Exploratory analyses

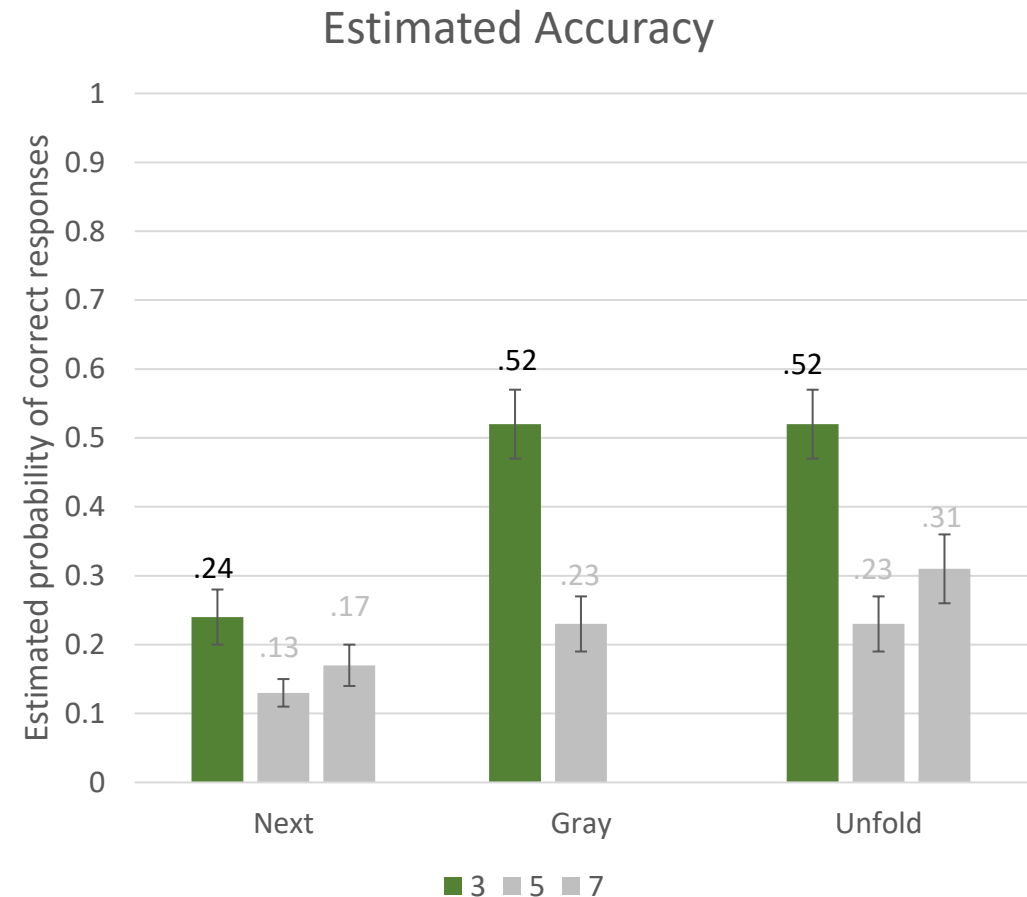
GLM Accuracy ~ Age + Edu + Device + Display Design * Condition

Contrast	Estimate	sd	z	p
Next 3				
Gray 3	1.25	0.08	16.2	<.001
Unfold 3	1.22	0.08	15.7	<.001
Next 5				
Gray 5	0.72	.08	8.95	<.001
Unfold 5	0.73	.08	8.91	<.001
Next 7				
Unfold 7	0.79	.08	9.95	<.001



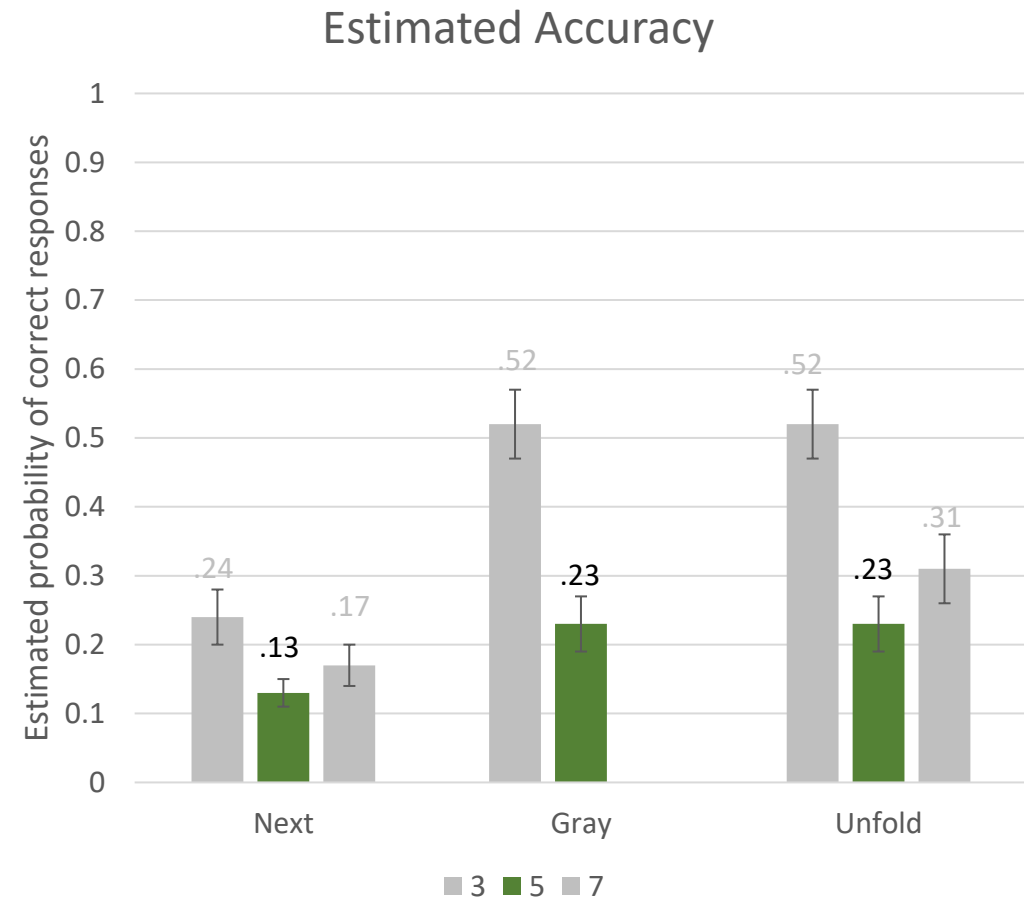
GLM Accuracy ~ Age + Edu + Device + Display Design * Condition

	Exp(B)	% Change
Next 3		
Gray 3	3.49	249%
Unfold 3	3.39	238%
Next 5		
Gray 5	2.05	105%
Unfold 5	2.08	107%
Next 7		
Unfold 7	2.20	120%



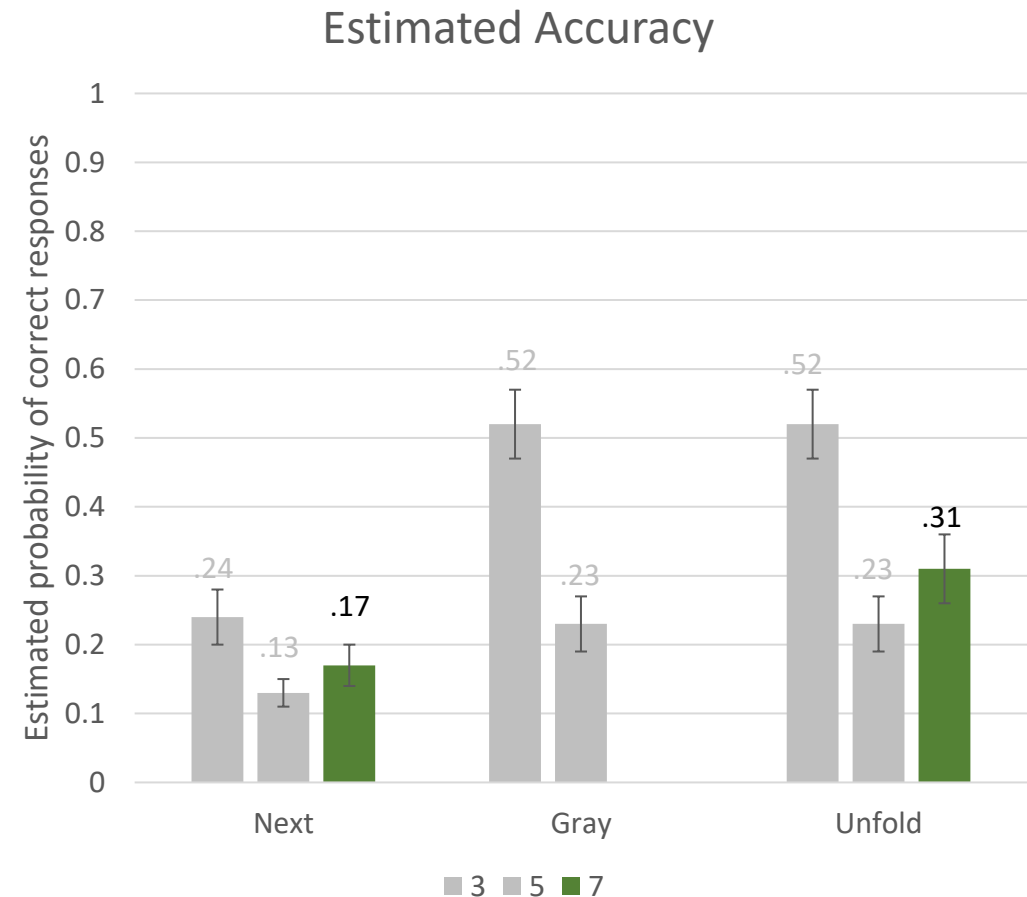
GLM Accuracy ~ Age + Edu + Device + Display Design * Condition

	Exp(B)	% Change
Next 3		
Gray 3	3.49	249%
Unfold 3	3.39	238%
Next 5		
Gray 5	2.05	105%
Unfold 5	2.08	107%
Next 7		
Unfold 7	2.20	120%



GLM Accuracy ~ Age + Edu + Device + Display Design * Condition

	Exp(B)	% Change
Next 3		
Gray 3	3.49	249%
Unfold 3	3.39	238%
Next 5		
Gray 5	2.05	105%
Unfold 5	2.08	107%
Next 7		
Unfold 7	2.20	120%



Summary of finding: Branching question

- Most participants provide accurate responses, as shown with the proportion of accuracy for the branching question. (Do you have more than one appliance at home?)
- Inaccurate responses are most likely to be observed in the Unfolding design, maybe due to a mismatch with respondents' expectation of burden.

Summary of finding: Follow-up questions

- “Next page” design lower accuracy than “grayed-out” and “unfolding” design across all levels of follow-up questions.
 - Caveat: Numeric data
- Follow-up questions: 3 higher accuracy than 5, 5 lower accuracy than 7.
 - Caveat: Different sample sizes (lower in “7 follow-up questions)

Recommendations for practitioners

- Avoid next-page design for follow-up questions with numeric data that needs to be broken down.
- For branching questions with numeric data, we recommend grayed-out design with the lowest possible number of follow-up questions (e.g., 3) for highest accuracy of responses in both branching and follow-up questions.