

17-803 Empirical Methods

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Survey Design (Part 2)

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Issues to consider when drafting questions

Social Desirability Bias

- ▶ Wanting to make a good impression
- ▶ “How often do you drive a car after drinking alcoholic beverages? Frequently, Occasionally, Seldom, Never, or Don’t Know.” (Dillman & Tarnai, 1991)
 - ▶ interviewer-administered telephone survey – 63% said “never”
 - ▶ self-administered paper survey – 52% responded “never”
- ▶ “How would you describe your current health? Excellent, Good, Fair, or Poor.”
 - ▶ fewer respondents choose “excellent” in self-administered surveys compared to interviews (Biemer, 1997; Hochstim, 1967).
 - ▶ conventional American greeting “How are you?” → always “Fine”

Social Desirability Bias

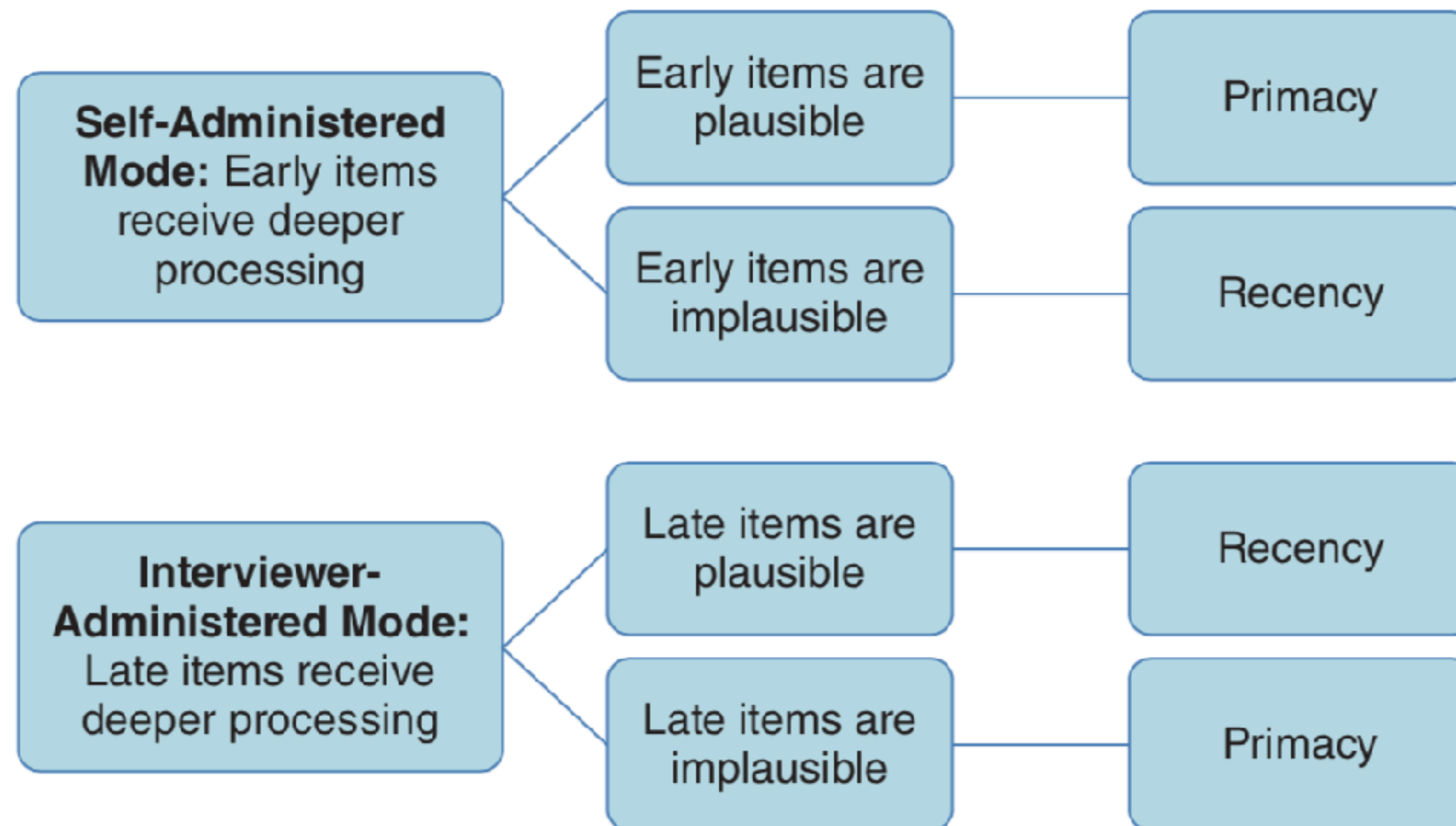
- ▶ Kreuter et al (2008):
 - ▶ 20% of web survey respondents denied having ever received a D or F in college when in fact they had received one of these grades.
- ▶ Catania et al (1996):
 - ▶ both men and women were more likely to report engaging in extramarital sex when interviewed by a same sex interviewer than when interviewed by an opposite sex interviewer.

Acquiescence

- ▶ The tendency to agree with someone rather than disagree
- ▶ Schuman and Presser (1981):
 - ▶ 60% agreed "Individuals are more to blame than social conditions for crime and lawlessness in this country."
 - ▶ 57% of a control group agreed with the exact reverse "Social conditions are more to blame than individuals for crime and lawlessness in this country."

Primacy and Recency

FIGURE 4.4 Cognitive elaboration model of response order effects.



Source: Adapted from "A Cognitive Model of Response Order Effects in Survey Measurement," by N. Schwarz, H. J. Hippler, and E. Noelle-Neumann, 1992, in N. Schwarz and S. Sudman (Eds.), *Context Effects in Social and Psychological Research* (pp. 187–201), New York, NY: Springer-Verlag.

Tendency to more frequently choose from among the first / last categories offered regardless of their content

Anchoring

- ▶ Occurs when an early response option forms a standard of comparison for later response options.
- ▶ Noelle-Neumann (1970): "Which food is more typically German?"
 - ▶ "potatoes" and "rice" – 30% said "potatoes"
 - ▶ "rice" and "potatoes" – 48% said "potatoes"



The anatomy of a survey question

Types of Survey Questions

Open-ended questions

Question stem **What is the most important problem facing Nebraska today?**

Answer space

Question stem with verbal and numeric instructions **How many years have you lived in Nebraska?**
Please report only whole numbers. For example, if you have lived in Nebraska 20 months, please round to 2 years.

Answer space with verbal and symbolic instruction Years lived in Nebraska

Closed-ended ordinal question

Question stem **Overall, how satisfied are you with living in Nebraska?**

- Answer choices*
- ☐ Completely satisfied
 - ☐ Very satisfied
 - ☐ Somewhat satisfied
 - ☐ Not too satisfied
 - ☐ Not at all satisfied

Types of Survey Questions

Body Height Reported by U.S. Men

As part of a comprehensive health survey, the U.S. CDC asked roughly 200,000 adult men in 2021 this question: "About how tall are you without shoes?"

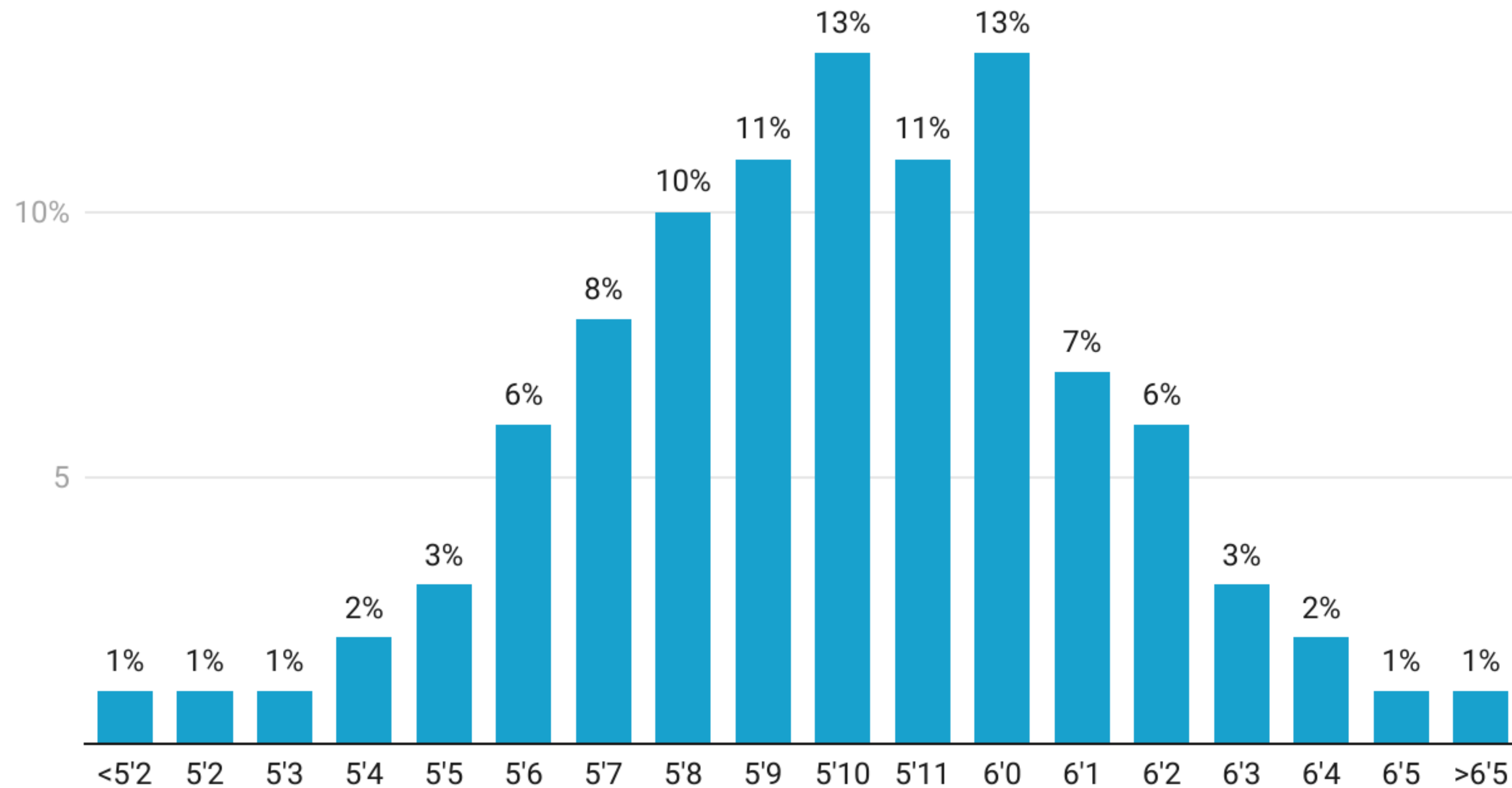


Chart: u/academiaadvice • Source: CDC

Types of Survey Questions

Closed-ended nominal question

Question stem **What is your current marital status?**

- Answer choices*
- ☐ Married
 - ☐ Living with a partner
 - ☐ Divorced
 - ☐ Separated
 - ☐ Widowed
 - ☐ Never married

Partially closed-ended question

Question stem **What are your favorite women's sports at the University of Nebraska?**

- Answer choices*
- ☐ Basketball
 - ☐ Cross Country
 - ☐ Gymnastics
 - ☐ Soccer
 - ☐ Softball
 - ☐ Swimming and Diving
 - ☐ Tennis
 - ☐ Volleyball
 - ☐ Other: Please specify

Use Specific and Concrete Words To Specify the Concepts Clearly

- ▶ Questions may be factual, but interesting ones usually involve concepts
- ▶ What are the concepts?

FIGURE 4.11 Use specific and concrete words to specify the concepts clearly.

Question with vague concepts

How many times did you eat together as a family last week?

☐ Number of meals

A revised question with more specific and concrete concepts

How many meals did you eat together as a family at home last week?

☐ Number of meals

A more specific revision

How many meals did you sit down to eat at home as a family last week?

☐ Number of meals

- ▶ Use previously-validated scales where possible

Guidelines for Forming Questions

- ▶ Choose the appropriate question format
- ▶ Make sure the question applies to the respondent
- ▶ Ask one question at a time
- ▶ Make sure the question is technically accurate
- ▶ Use simple and familiar words
- ▶ Use specific and concrete words to specify the concepts clearly
- ▶ Use as few words as possible to pose the question
- ▶ Use complete sentences that take a question form, and use simple sentence structures
- ▶ Make sure “yes” means yes and “no” means no
- ▶ Organize questions to make it easier for respondents to comprehend the response task

How to Write Open- and Closed-Ended Questions

Open Ended Questions – Wording Specificity

FIGURE 5.1 How specificity of question wording affects reports about when students began their studies.

Question Wording (Telephone)	% Reporting Month and Year	% Reporting Season/Semester
<u>When</u> did you begin your studies at Washington State University?	13.4	57.3
<u>What date</u> did you begin your studies at Washington State University?	49.5	32.3
<u>What month and year</u> did you begin your studies at Washington State University?	83.7	11.0

Source: "Helping Respondents Get It Right the First Time: The Influence of Words, Symbols, and Graphics in Web Surveys," by L. M. Christian, D. A. Dillman, and J. D. Smyth, 2007b, *Public Opinion Quarterly*, 71(1), pp. 113–125.

Open Ended Questions — Provide Extra Motivation To Respond

- ▶ “In your own words, how would you describe your adviser(s)?”

Vs

- ▶ “This question is very important to understanding the Washington State University student experience. Please take your time answering it.

In your own words, how would you describe your adviser(s)?”

Open Ended Questions – Use Nondirective Probes To Obtain More Information

- ▶ Smyth et al. (2007b) – “What businesses would you most like to see in the Pullman and Moscow area that are currently not available?”
 - ▶ A random half of students received a follow-up probe asking, “Are there any others?”
- ▶ No probe: average of 1.8 businesses
- ▶ Probe: average of 2.4 businesses

Open Ended Questions – the Type of Probe Used Will Strongly Impact the Amount and Type of Information Received

- ▶ Smyth et al. (2006) – “In your own words, how would you describe your adviser or advisers?”
- ▶ Probes:
 - ▶ “Is there anything else?” – 18% responded; most said “no”
 - ▶ “Can you tell me more about that?” – 82% responded with additional information, including new ideas or themes as well as elaboration on previously reported themes

Closed Ended Questions – Acquiescence

Poor Designs

Do you favor congressional term limits of four years?

- ☐ Favor
- ☐ Oppose

How satisfied are you with the overall service you have received from your financial consultant?

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

Closed Ended Questions – Acquiescence

FIGURE 5.4 State both positive and negative sides in the question stem.

<u><i>Poor Designs</i></u>	<u><i>Improved Designs</i></u>
Do you favor congressional term limits of four years? <input type="radio"/> Favor <input type="radio"/> Oppose	Do you favor or oppose congressional term limits of four years? <input type="radio"/> Favor <input type="radio"/> Oppose
How satisfied are you with the overall service you have received from your financial consultant? <input type="radio"/> Very satisfied <input type="radio"/> Somewhat satisfied <input type="radio"/> Somewhat dissatisfied <input type="radio"/> Very dissatisfied	How satisfied or dissatisfied are you with the overall service you have received from your financial consultant? <input type="radio"/> Very satisfied <input type="radio"/> Somewhat satisfied <input type="radio"/> Somewhat dissatisfied <input type="radio"/> Very dissatisfied

Closed Ended Questions – Primacy

FIGURE 5.7 Subtraction effects in multiple-answer questions.

Which of the following resources have you used at WSU? Please check all that apply.			
<u>Original Order</u>	<u>%</u> <u>Endorsing</u>	<u>Reverse Order</u>	<u>%</u> <u>Endorsing</u>
Libraries	95	Counseling Services	
Computer Labs		Library Instruction	52
Student Health Center		Campus-Sponsored Tutoring	
Academic Advising		Career Services	
Student Recreation Center		Internet/E-Mail Access	
Internet/E-Mail Access		Student Recreation Center	
Career Services		Academic Advising	
Campus-Sponsored Tutoring		Student Health Center	
Library Instruction	20	Computer Labs	
Counseling Services		Libraries	93

Closed Ended Questions – Forced Choice

Check-all-that-apply formatted question

Which of the following items do you have? Please check all that apply.

- ☐ Desktop computer
- ☐ Laptop computer
- ☐ Cell phone
- ☐ E-reader
- ☐ Tablet computer
- ☐ iPod or MP3 player

Closed Ended Questions – Forced Choice

FIGURE 5.12 Replacing check-all-that-apply questions with a forced-choice format.

Check-all-that-apply formatted question

Which of the following items do you have? Please check all that apply.

- ☐ Desktop computer
- ☐ Laptop computer
- ☐ Cell phone
- ☐ E-reader
- ☐ Tablet computer
- ☐ iPod or MP3 player

A revision converting to the forced-choice format

Do you have each of the following items or not?

- | Yes | No | |
|-----------------------|-----------------------|--------------------|
| <input type="radio"/> | <input type="radio"/> | Desktop computer |
| <input type="radio"/> | <input type="radio"/> | Laptop computer |
| <input type="radio"/> | <input type="radio"/> | Cell phone |
| <input type="radio"/> | <input type="radio"/> | E-reader |
| <input type="radio"/> | <input type="radio"/> | Tablet computer |
| <input type="radio"/> | <input type="radio"/> | iPod or MP3 player |

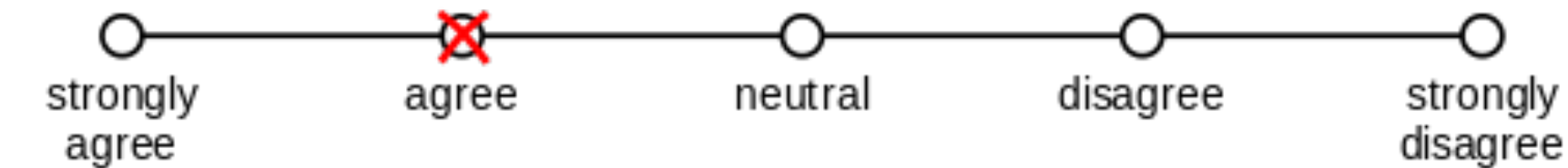
Understanding Likert scales better

Likert Scale

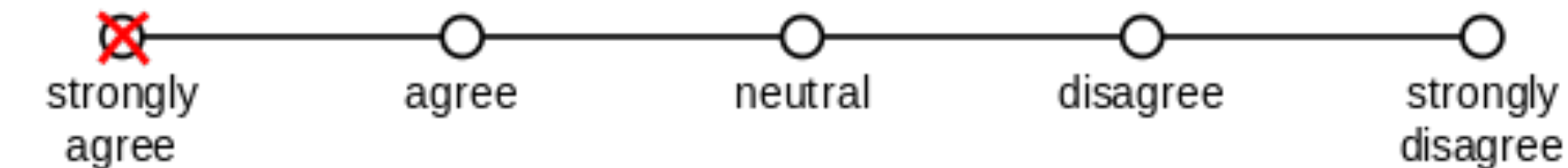
(Pronounced Lick-Ert)

Website User Survey

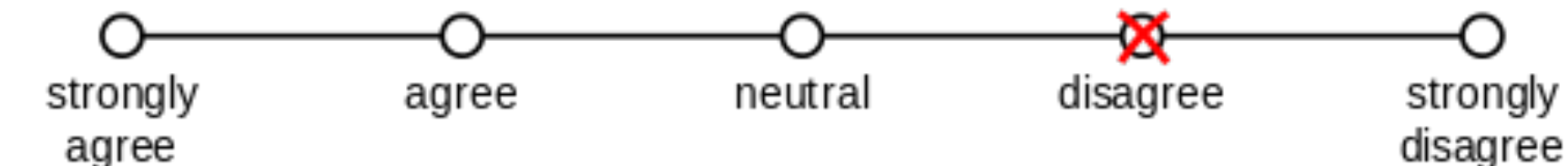
1. The website has a user friendly interface.



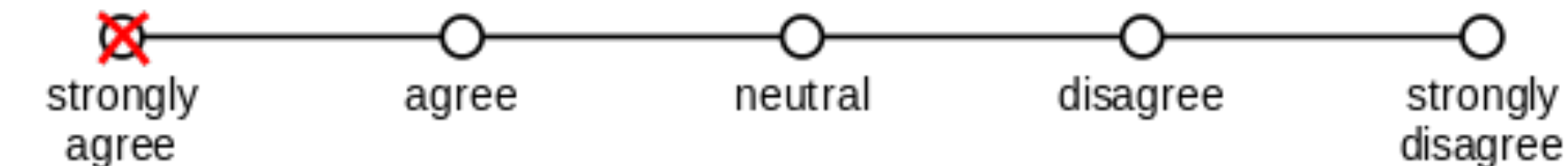
2. The website is easy to navigate.



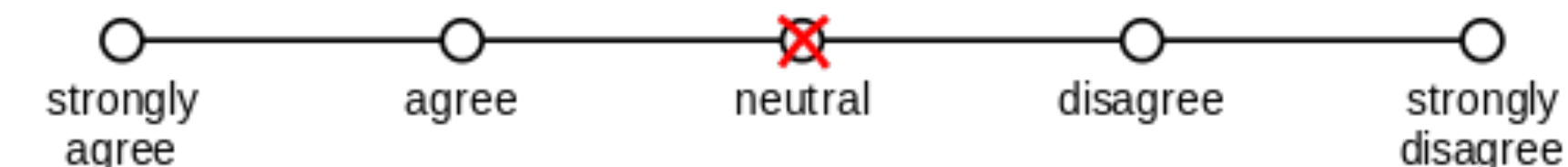
3. The website's pages generally have good images.



4. The website allows users to upload pictures easily.



5. The website has a pleasing color scheme.



"Example Likert Scale using five Likert Items
pertaining to Wikipedia" CC-BY-SA-3.0 Wikipedia

Likert Scale (Pronounced Lick-Ert)

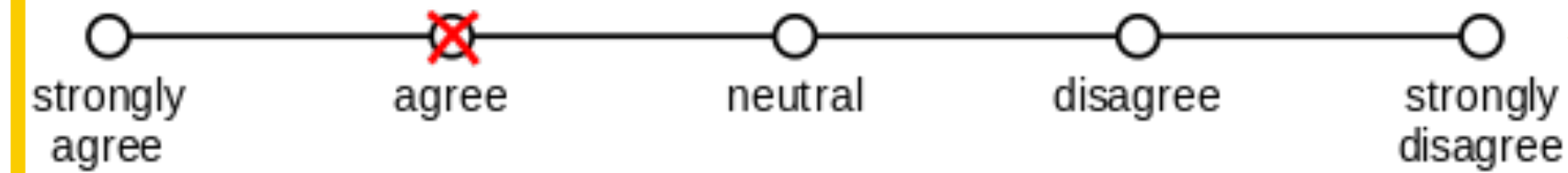
"strongly disagree" = 1

...

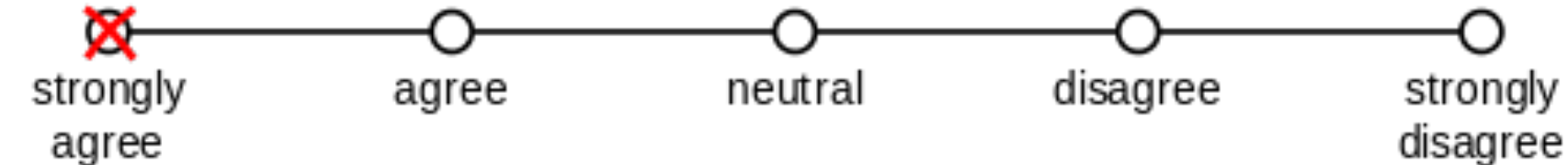
"strongly agree" = 5

Website User Survey

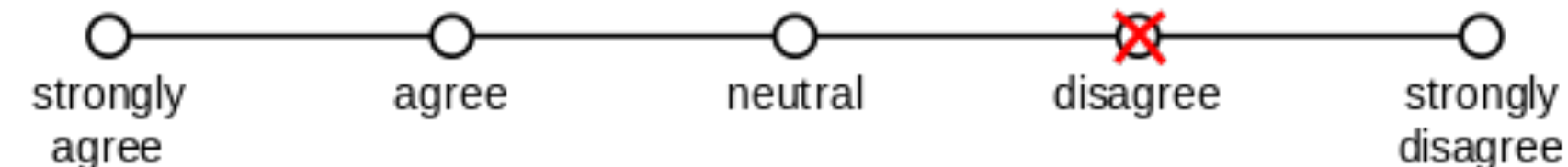
1. The website has a user friendly interface.



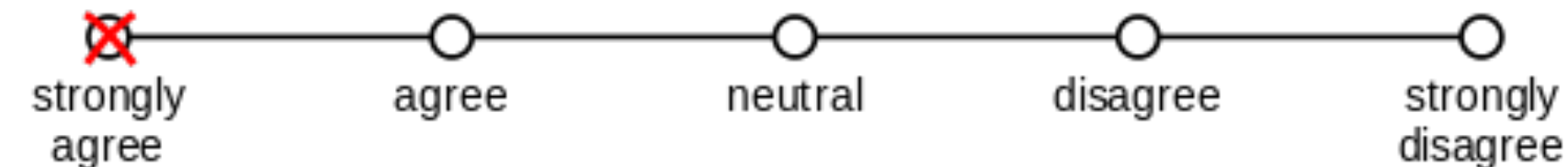
2. The website is easy to navigate.



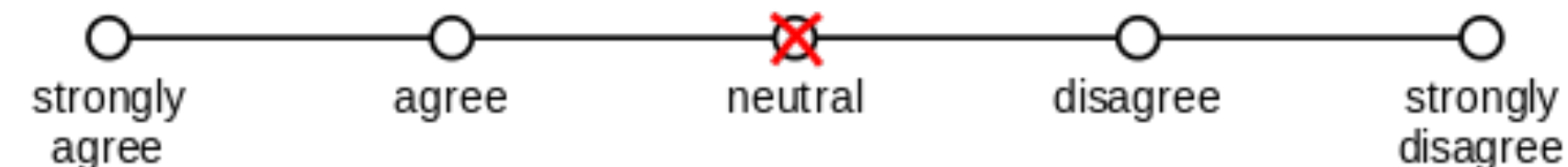
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Likert item

Likert Scale

"Example Likert Scale using five Likert Items
pertaining to Wikipedia" CC-BY-SA-3.0 Wikipedia

Concerns: Reliability – Is Whatever Is Being Measured Reliably Found?

- ▶ Statistical or internal reliability (aka “**consistency**”):
 - ▶ The extent to which the items of a scale are consistent with each other.
 - ▶ Typically evaluated using Cronbach’s α
 - ▶ A good scale should have a good split-half correlation.
 - ▶ Cronbach’s α is effectively the average of all the possible split-half correlations.
- ▶ Reliability over time (aka “**stability**”)
 - ▶ Over time, people should answer the same items the same way.
 - ▶ Especially for stable attributes like attitude or personality

Concerns: Validity – Does Whatever Is Being Measured Correspond to the Concept That We Say It Does?

- ▶ Do scales with different response formats agree with each other?
 - ▶ e.g., similar mean values with different items
- ▶ Do items correlate with reference criteria of what the concept means?

Should Items Have a Midpoint?

1. I like massively multiplayer online role-playing games (MMORPG)

Strongly
Disagree

Disagree

Neither

Agree

Strongly
Agree

Should Items Have a Midpoint?

Really ambivalent about their attitude or simply do not have an opinion?

1. I like massively multiplayer online role-playing games (MMORPG)
Strongly Disagree Disagree Neither Agree Strongly Agree
2. I like massively multiplayer online role-playing games (MMORPG)
Strongly Disagree Disagree Agree Strongly Agree
3. I like massively multiplayer online role-playing games (MMORPG)
Strongly Disagree Disagree Agree Strongly Agree No Opinion

Figure 15.2 Three formats of Likert item: 1. with midpoint; 2. no midpoint; 3. no midpoint but option to have no opinion

One Problem of Having a Midpoint Is That of Acquiescence Bias

- ▶ A neutral option means respondents can comfortably avoid disagreeing even if they do actually disagree.
- ▶ Garland (1991) experiment:
 - ▶ 4-point (no midpoint) vs 5-point items
 - ▶ scale scores were higher for the 5-point items
 - ▶ But Nadler et al (2015) found no statistically significant differences

But Bias Could Also Occur in the Opposite Direction

- ▶ 4-point item: Forcing people to respond in a way that they did not truly feel would introduce an element of randomness into the answers.

Likert Item Design Summary

- ▶ Likert items are pretty robust to variations in response format.
 - ▶ Midpoint vs not
 - ▶ 5 vs 7 options
 - ▶ Strongly disagree, Disagree, Neither, Agree, Strongly agree
 - ▶ Strongly disagree, Moderately disagree, Slightly disagree, Neither, Slightly agree, Moderately agree, Strongly agree
 - ▶ All-labeled vs just end-points labeled
 - ▶ Strongly Disagree, Disagree, Neither, Agree, Strongly Agree
 - ▶ Strongly Disagree, 1, 2, 3, 4, 5, Strongly Agree
- ▶ Use larger scales over single items.

Example: Questionnaire to Seventh' Graders Pleasure in Writing

- ▶ I love writing.
- ▶ Writing is my favorite school subject.
- ▶ When I write, I feel well.
- ▶ I hate writing.
- ▶ I write as soon as I get the chance.
- ▶ I make sure that I have to write as less as possible.
- ▶ I write more than my class mates.
- ▶ When I write, I prefer to do something different.
- ▶ Writing gives me pleasure.
- ▶ I just write, when I can get a good grade for it.
- ▶ Writing is boring.
- ▶ I like different kinds of writing.
- ▶ When I have the opportunity to determine on my own what I do in the Dutch class, I usual do a writing task.
- ▶ I write even if the teacher does not assign a writing task.
- ▶ I would like to spend more time on writing.
- ▶ Writing is a waste of time.
- ▶ I always look forward to writing lessons.
- ▶ I write because I have to at school.
- ▶ I like it to write down my thoughts.
- ▶ I would like to write more at school.

Example: Questionnaire to Seventh' Graders Pleasure in Writing

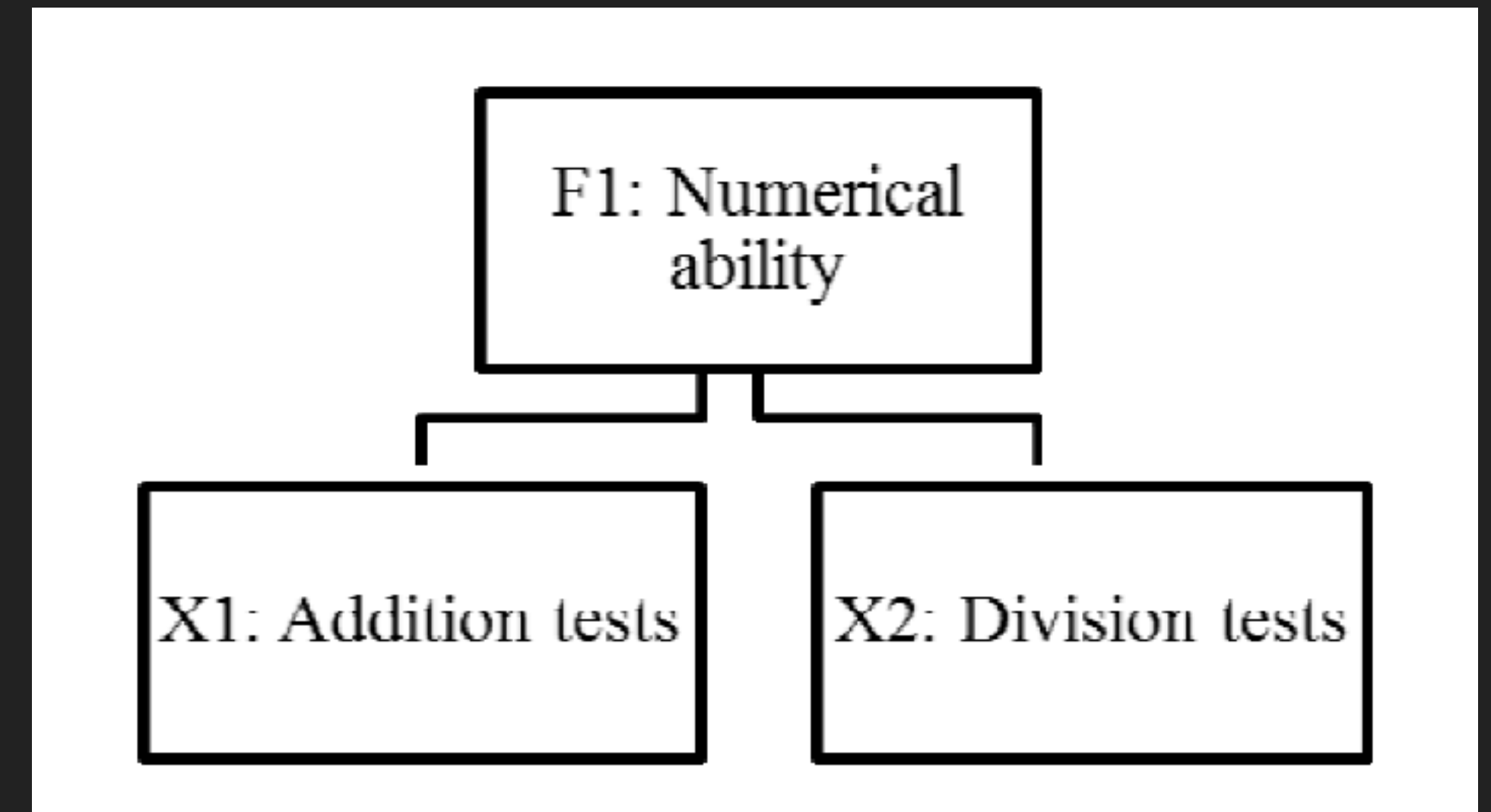
- ▶ I love writing.
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Factor Analysis To Assess Construct Validity

- ▶ Factor analysis:
 - ▶ A common data summarization technique.
 - ▶ Used to regroup variables into a limited set of clusters based on shared variance.
 - ▶ Helps to isolate constructs and concepts.
- ▶ In this context:
 - ▶ Exploratory factor analysis detects the constructs - i.e. factors - that underlie a dataset based on the correlations between questionnaire items.
 - ▶ The factors that explain the highest proportion of variance the questionnaire items share are expected to represent the underlying constructs.



Factor Extraction

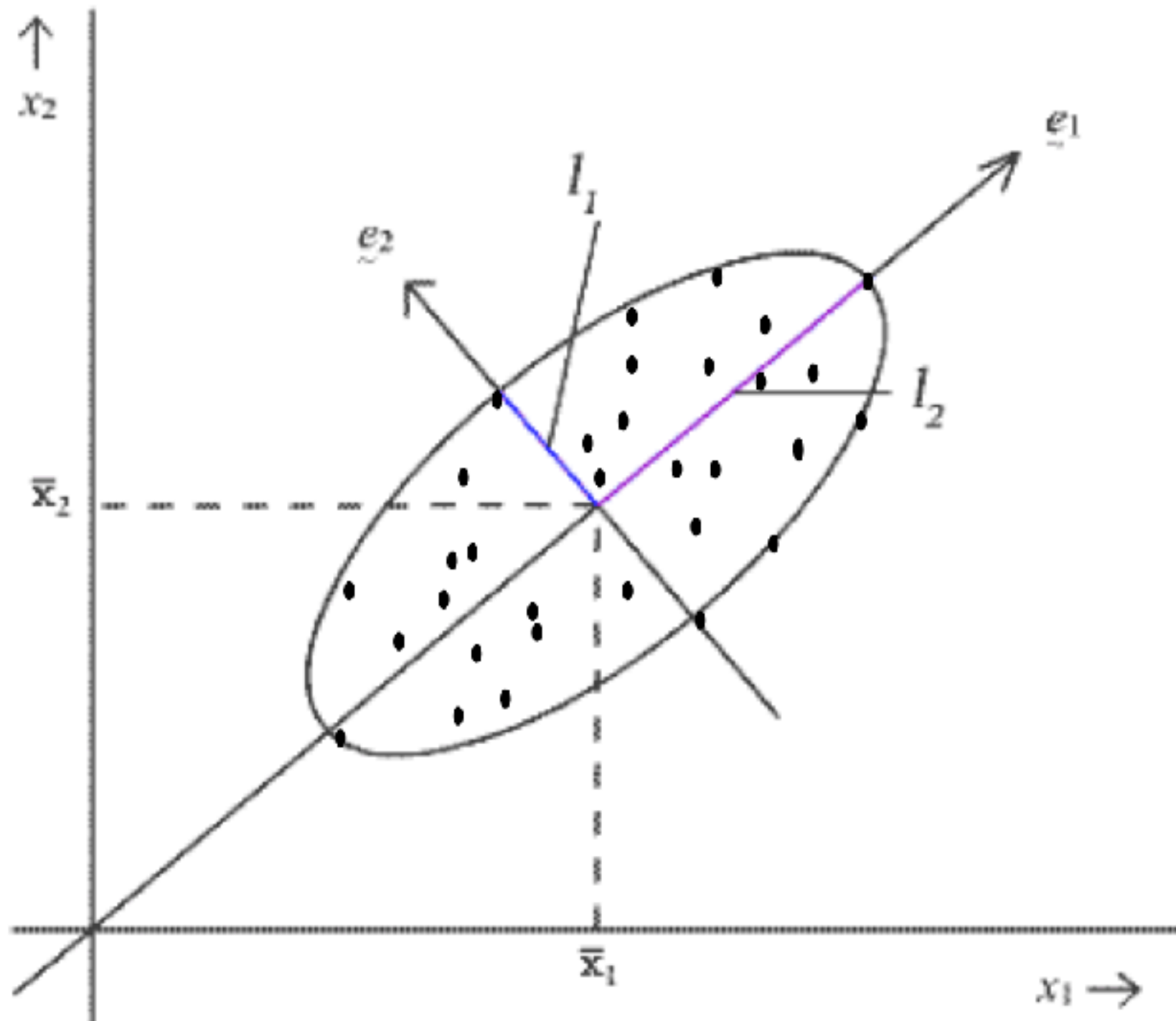


Figure 2. Scatterplot of two variables (x_1 and x_2). The lines e_1 and e_2 represent the eigenvectors of the correlation matrix of variables x_1 and x_2 . The eigenvalue of an eigenvector is the length of an eigenvector measured from one end of the oval to the other end.

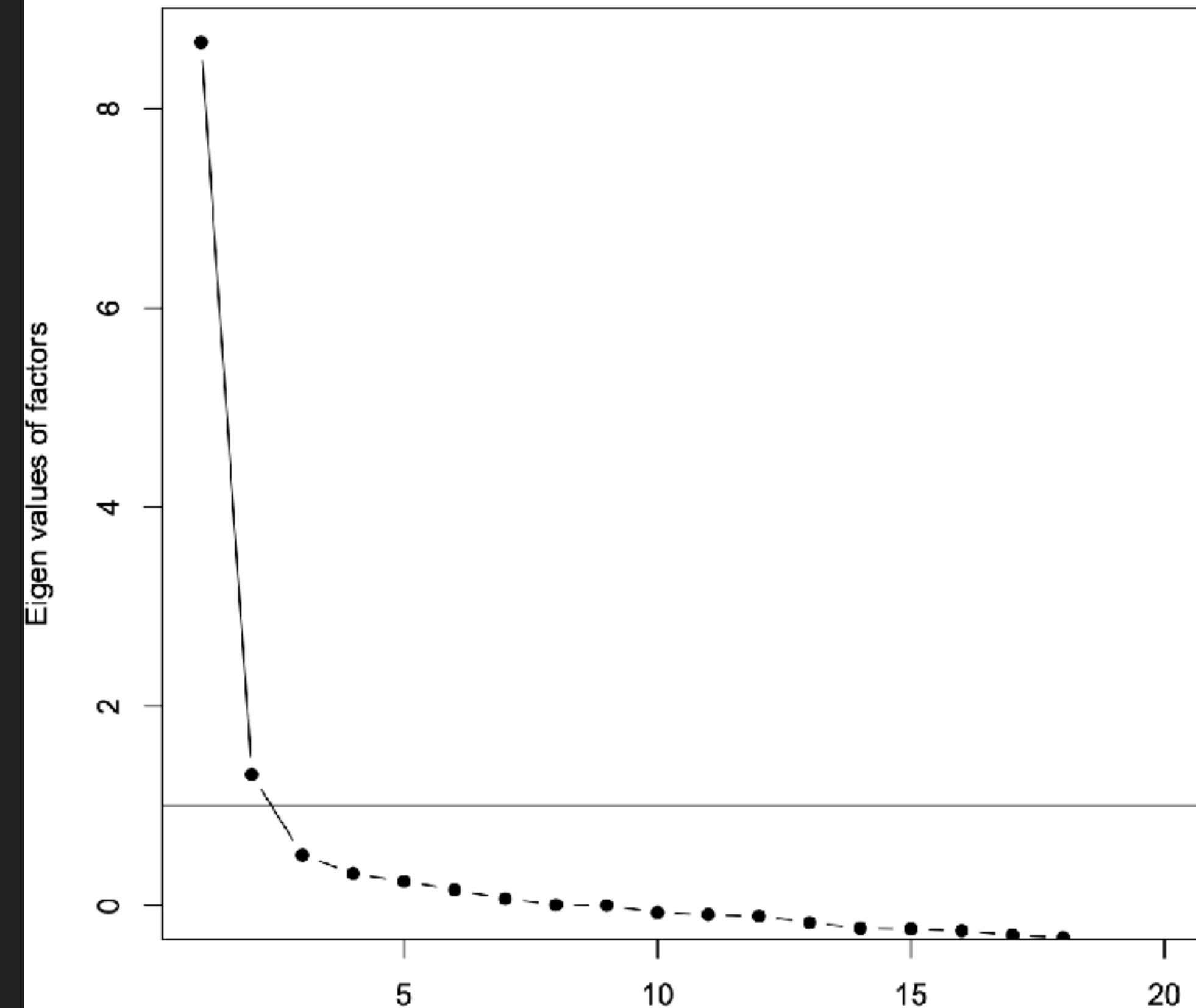


Figure 3. Screeplot of factors underlying the dataset. Every point represents one factor.

The Positively Formulated Items in This Questionnaire Make Up the First Factor and the Negatively Formulated Items the Second Factor.

- ▶ p01. I love writing.
- ▶ p02. Writing is my favorite school subject.
- ▶ p03. When I write, I feel well.
- ▶ p04. I hate writing.
- ▶ p05. I write as soon as I get the chance.
- ▶ p06. I make sure that I have to write as less as possible.
- ▶ p07. I write more than my class mates.
- ▶ p08. When I write, I prefer to do something different.
- ▶ p09. Writing gives me pleasure.
- ▶ p10. I just write, when I can get a good grade for it.
- ▶ p11. Writing is boring.
- ▶ p12. I like different kinds of writing.
- ▶ p13. When I have the opportunity to determine on my own what I do in the Dutch class, I usual do a writing task.
- ▶ p14. I write even if the teacher does not assign a writing task.
- ▶ p15. I would like to spend more time on writing.
- ▶ p16. Writing is a waste of time.
- ▶ p17. I always look forward to writing lessons.
- ▶ p18. I write because I have to at school.
- ▶ p19. I like it to write down my thoughts.
- ▶ p20. I would like to write more at school.

```
Call:
factanal(x = na.omit(passion), factors = 2, rotation = "oblimin")

Loadings:
      Factor1 Factor2
p01  0.547  -0.289
p02  0.747
p03  0.727
p04      0.802
p05  0.625
p06      0.641
p07  0.463
p08 -0.133  0.558
p09  0.702 -0.115
p10      0.597
p11      0.680
p12  0.412 -0.243
p13  0.719  0.122
p14  0.739
p15  0.758
p16      0.771
p17  0.917
p18      0.739
p19  0.623
p20  0.771

SS loadings      Factor1 Factor2
Proportion Var   6.141    3.534
Cumulative Var   0.307    0.177
Cumulative Var   0.307    0.484

Factor Correlations:
      Factor1 Factor2
Factor1  1.000  -0.642
Factor2 -0.642   1.000

Test of the hypothesis that 2 factors are sufficient.
The chi square statistic is 197.76 on 151 degrees of freedom.
The p-value is 0.00636
```


The Positively Formulated Items in This Questionnaire Make Up the First Factor and the Negatively Formulated Items the Second Factor.

- ▶ p01. I love writing.
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Call: factanal(x = na.omit(passion), factors = 2, rotation = "oblimin")				
Loadings:				
	Factor1	Factor2		
p01	0.547	-0.289		
p02	0.747		SS loadings	6.141 3.534
p03	0.727		Proportion Var	0.307 0.177
p04		0.802	Cumulative Var	0.307 0.484
p05	0.625			
p06		0.641		
p07	0.463		Factor Correlations:	
p08	-0.133	0.558	Factor1	1.000 -0.642
p09	0.702	-0.115	Factor2	-0.642 1.000
p10		0.597		
p11		0.680		
p12	0.412	-0.243		
p13	0.719	0.122	Test of the hypothesis that 2 factors are sufficient.	
p14	0.739		The chi square statistic is 197.76 on 151 degrees of freedom.	
p15	0.758		The p-value is 0.00636	
p16		0.771		
p17	0.917			
p18		0.739		
p19	0.623			
p20	0.771			

Common pattern that reverse-phrased items load on a different factor (Schmitt & Stults, 1985)

Cronbach's Alpha Analysis

Reliability analysis					
Call: alpha(x = passion)					
	alpha	average_r	mean	sd	
	0.93	0.42	3.3	0.36	
Reliability if an item is dropped:			Item statistics		
	alpha	average_r	n	r	r.cor mean sd
p01	0.93	0.41	p01 114	0.77	0.76 3.5 1.19
p02	0.93	0.42	p02 114	0.68	0.67 3.9 1.07
p03	0.93	0.41	p03 114	0.77	0.76 3.6 1.06
p04-	0.93	0.42	p04- 114	0.70	0.69 3.3 1.29
p05	0.93	0.43	p05 113	0.57	0.55 3.8 0.90
p06-	0.93	0.42	p06- 114	0.61	0.59 3.0 1.19
p07	0.93	0.43	p07 114	0.55	0.52 3.4 0.82
p08-	0.93	0.42	p08- 114	0.63	0.60 2.6 1.18
p09	0.93	0.41	p09 114	0.78	0.77 3.6 0.98
p10-	0.93	0.43	p10- 114	0.59	0.57 2.5 1.23
p11-	0.93	0.42	p11- 114	0.60	0.58 3.1 1.26
p12	0.93	0.42	p12 114	0.62	0.59 3.0 1.00
p13	0.93	0.42	p13 114	0.60	0.57 3.4 1.08
p14	0.93	0.42	p14 114	0.71	0.70 3.7 1.01
p15	0.93	0.42	p15 114	0.71	0.70 3.8 0.95
p16-	0.93	0.42	p16- 113	0.63	0.62 3.4 1.12
p17	0.93	0.41	p17 113	0.80	0.80 3.8 0.85
p18-	0.93	0.42	p18- 114	0.62	0.61 2.6 1.17
p19	0.93	0.42	p19 114	0.67	0.66 3.2 1.06
p20	0.93	0.41	p20 114	0.77	0.76 3.8 0.94

Table 4. Output of a Cronbach's alpha analysis in R

Example: Multi-Item Scale for Brainstorming

1. The group aimed to generate as many ideas as possible.
2. All ideas were welcome, no matter how unconventional they were.
3. The group tried to combine similar ideas into one.
4. The group aimed to build on the ideas generated.
5. Ideas were generated first individually, then discussed as a group.
6. An organizer or group leader facilitated brainstorming for my session/group.
7. Group members criticized ideas proposed during the group/session. (R)

Responses on 5-point Likert scale, asked to what extent the statement reflected the way their group decided to work, from “not at all” to “completely.”

Analyzed inter-item reliability (Cronbach's α), had to drop #7

From: Filippova, A., Trainer, E., & Herbsleb, J. D. (2017). *From diversity by numbers to diversity as process: supporting inclusiveness in software development teams with brainstorming*. Paper presented at the International Conference on Software Engineering, Buenos Aires, Argentina.

Survey Examples

- ▶ Ecosystem survey

http://cmu.ca1.qualtrics.com/jfe/form/SV_d4M66VwPlZYd5kh

- ▶ Results: <http://breakingapis.org/survey/>

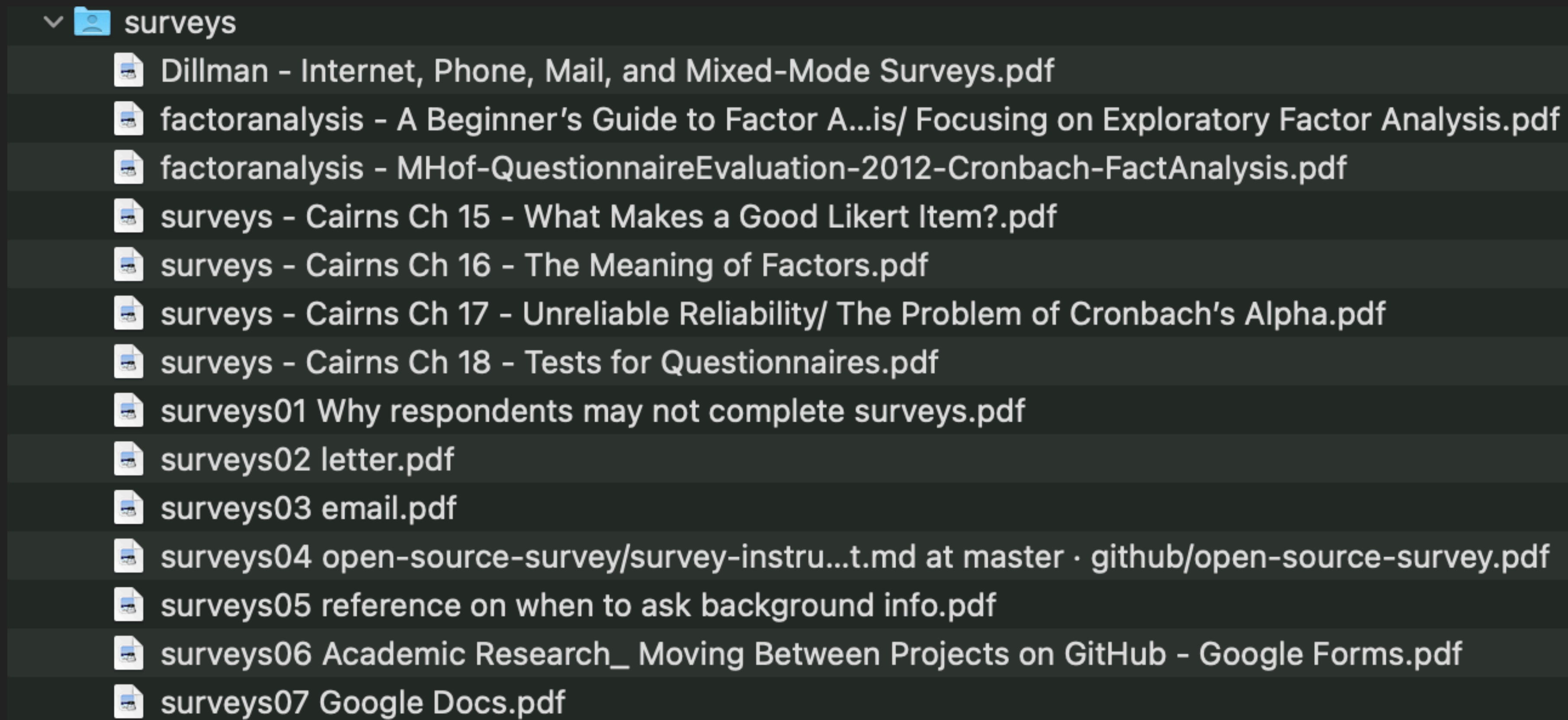
- ▶ GitHub open source survey

<https://github.com/github/open-source-survey>

- ▶ Results: <http://opensourcesurvey.org/2017/>

Readings

- ▶ https://drive.google.com/drive/folders/1ISOQlbw-cRmT47_itpIJkTZua_IASNgB?usp=sharing



Credits

▶ Graphics:

- ▶ Dave DiCello photography (cover)

▶ Content:

- ▶ Chapters from Dillman, D., Smyth, J. D., & Christian, L. M. (2014). *Internet, Phone, Mail and Mixed-Mode Surveys: The Tailored Design Method* (4th ed.). Hoboken, NJ: Wiley.
 - ▶ Ch1: Sample Surveys in our Electronic World
 - ▶ Ch2: Reducing People's Reluctance to Respond to Surveys
 - ▶ Ch4: The Fundamentals of Writing Questions
 - ▶ Ch5: How to Write Open and Closed Ended Questions
- ▶ Hof, M. (2012). *Questionnaire Evaluation with Factor Analysis and Cronbach's Alpha*. Student project. Seminar in Methodology and Statistics. University of Groningen
- ▶ Yong, A. G., & Pearce, S. (2013). *A beginner's guide to factor analysis: Focusing on exploratory factor analysis*. *Tutorials in quantitative methods for psychology*, 9(2), 79-94.
- ▶ Cairns, P. (2019). *Doing better statistics in human-computer interaction*. Cambridge University Press.
 - ▶ Ch15: What Makes a Good Likert Item?
 - ▶ Ch16: The Meaning of Factors
 - ▶ Ch17: Unreliable Reliability: The Problem of Cronbach's Alpha
 - ▶ Ch18: Tests for Questionnaires