

# Using Eye Tracking Data to Understand Respondent's Processing of Rating Scales

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# Previous Findings

## Visual Design of Rating Scales

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- Use of visual design features (Christian & Dillman, 2004; Christian et al., 2009)
  - to enhance understanding of survey questions and its components
  - to draw respondent's attention to specific elements
- Some best practices (Friedman & Amoo, 1999)
  - Rating scale items commonly arranged in grids (space- and time-saving)
  - Response options should be verbally/fully labeled,  $7 \pm 2$  in number, midpoint included, etc.
- Providing a nonsubstantive option ("don't know", "no opinion")
  - More "nonattitudes" due to satisficing vs. midpoint and random responding (Derouvray & Couper, 2002)
  - Varying effects depending on visual design and spatial arrangement (Christian et al., 2009; Tourangeau et al., 2004)

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# Visual Design

## Graphical Location of Nonsubstantive Options



- In general, visual separation may encourage respondents to perceive the substantive response options separately from the nonsubstantive.
- Assumption 1: Without visual separation, respondents may mistakenly interpret the visual midpoint as the conceptual midpoint.
  - significantly shifted means when no visual separation by divider line/ spacing (Tourangeau et al., 2004);
  - versus significantly shifted means when visually separated by additional space (Christian et al., 2009)
- Assumption 2: Visual prominence may enhance nonsubstantive responses.
  - by tendency, more nonsubstantive responses when visually separated (Tourangeau et al., 2004);
  - versus tendentially more nonsubstantive responses when no separation (Christian et al., 2009)

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# Research Questions

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1. How does different visual presentation of nonsubstantive response options affect survey responses?
  - a. Shifted means towards one side of the rating scale?
  - b. Increased incidence of nonsubstantive responses?
  
2. Is the effect on survey responses mediated by varying attention to substantive and nonsubstantive components of the rating scale?
  - a. Increased attention to substantive options on one side when not separated?
  - b. Increased attention to the nonsubstantive option when visually separated?

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# Methods



- Lab experiment:
  - „Studies and Occupation“ Web survey (Jan/Feb, 2013)
  - Students recruited on campus (N=126)
  - Between-subjects design with random assignment  
(with 26 of 39 survey questions being part of experimentation)
  
- Eye tracking equipment:
  - Monocular, remote mounted eye tracking system
  - 19 inch monitor
  - 60 Hz sampling rate

# Design

## Experimental Conditions

**My study experiences meet my expectations I had before beginning my studies concerning...**

**CG: Nonsubstantive not provided**

**EG1: Nonsubstantive provided, not visually separated**

**EG2: Nonsubstantive provided, visually separated**

	does not apply at all	does rather not apply	does rather not apply	applies fully	had no expectations
the course content.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the conditions of studying.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the study and examination requirements.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the career prospects offered.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the study-related time exposure (workload).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# Results

## Survey Data I

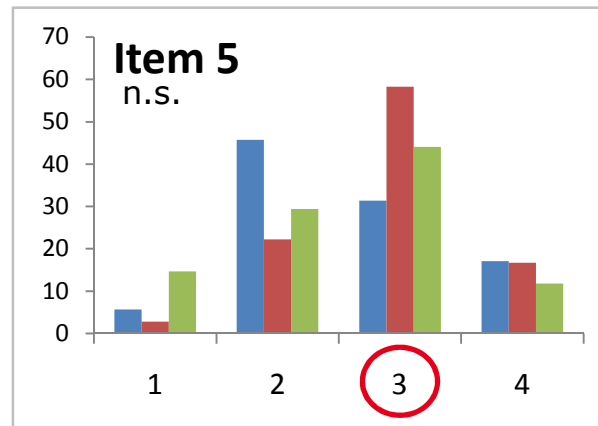
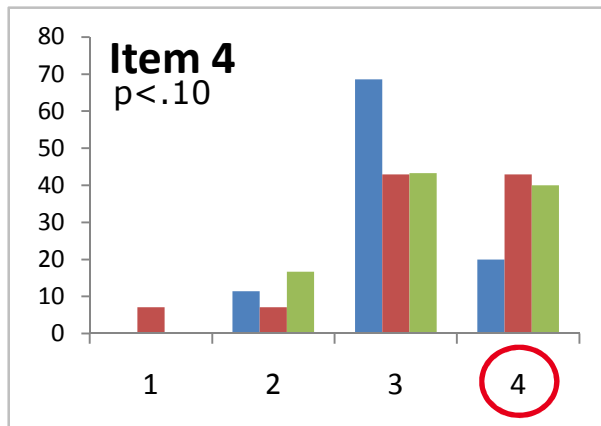
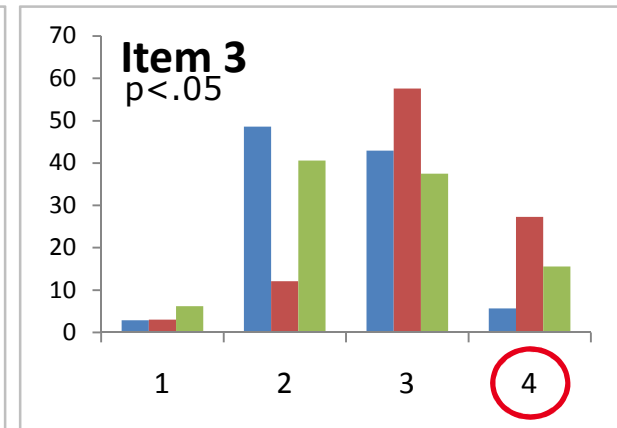
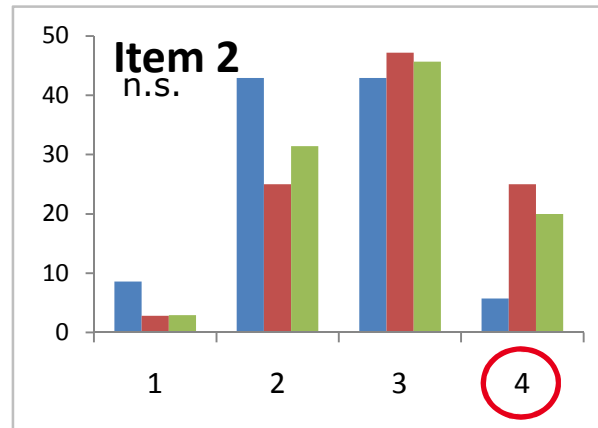
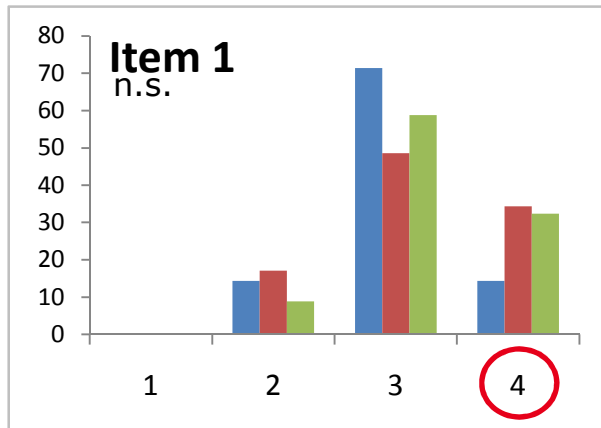


<b>% nonsubstantive</b>	<b>Item 1</b>	<b>Item 2</b>	<b>Item 3</b>	<b>Item 4</b>	<b>Item 5</b>
no separation	7.9	5.3	13.2	26.3	5.3
separation	2.9	0.0	8.6	11.8	2.9
<i>Chi<sup>2</sup>-Test</i>	<i>n.s.</i>	<i>n.s.</i>	<i>n.s.</i>	<i>n.s.</i>	<i>n.s.</i>

<b>mean substantive responses</b>	<b>Item 1</b>	<b>Item 2</b>	<b>Item 3</b>	<b>Item 4</b>	<b>Item 5</b>	<b>mean index</b>
no nonsubstantive	3.0	2.5	2.5	3.1	2.6	2.7
no separation	3.2	2.9	3.1	3.2	2.9	3.0
separation	3.2	2.8	2.6	3.2	2.5	3.0
<i>F-Test</i>	<i>n.s.</i>	<i>p</i> <.05	<i>p</i> <.01	<i>n.s.</i>	<i>n.s.</i>	<i>p</i> <.05

# Results

## Survey Data II



■ CG: no nonsubstantive  
■ EG1: no separation  
■ EG2: separation



# Results

## Survey Data: Summary



Findings: survey data	Potential explanation	Inspection: eye tracking
shifted means when <u>no</u> separation  → consistent with 1 <sup>st</sup> assumption	Visual separation prevents respondents from misinterpreting the visual midpoint as the conceptual midpoint	Attention shift towards the right side of the scale
nonsubstantive responses increased when <u>no</u> separation  → inconsistent with 2 <sup>nd</sup> assumption	<i>Visual</i> distinction: Visual separation prevents potential misinterpretation of the nonsubstantive option being a substantive one  <i>Content</i> distinction: Visual separation lowers perceived acceptance and discourages from selecting the nonsubstantive option	Extent of attention to and sequential processing of the nonsubstantive option

# Eye Tracking Data

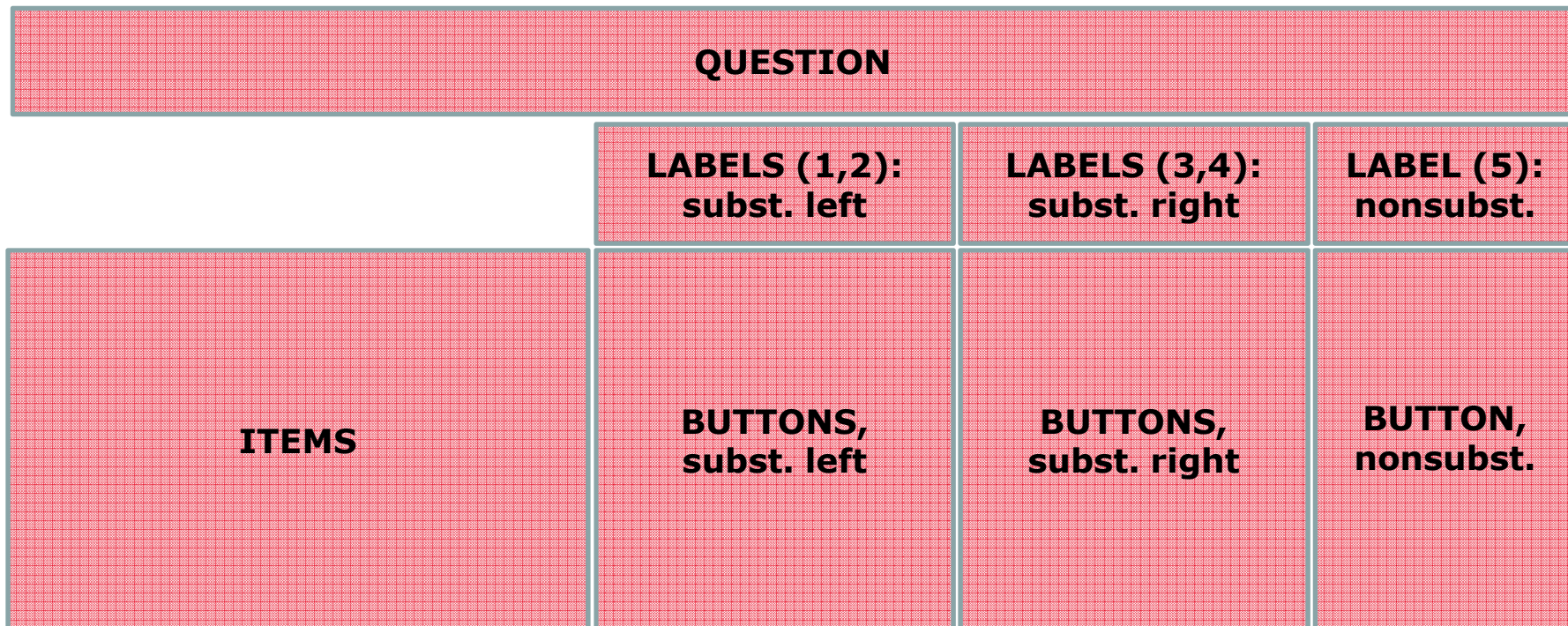
## Areas of Interest (AOI)

My study experiences meet my expectations I had before beginning my studies concerning...

	does not apply at all	does rather not apply	does rather not apply	applies fully	had no expectations
the course content.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the conditions of studying.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the study and examination requirements.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the career prospects offered.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the study-related time exposure (workload).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# Eye Tracking Data

## Target AOIs



# Results

## Eye Tracking Data I: within entire process time



target AOIs	fixation count (n)				fixation duration (s)					
	CG	EG1	EG2	<i>F-Test</i>	CG	EG1	EG2	<i>F-Test</i>		
question	32	29	28	<i>n.s.</i>	5.9	5.8	5.5	<i>n.s.</i>		
items	39	39	38	<i>n.s.</i>	7.4	7.7	7.3	<i>n.s.</i>		
labels l	11	10	9	<i>n.s.</i>	2.4	2.5	2.1	<i>n.s.</i>		
labels r	9	11	10	<i>n.s.</i>	2.5	2.9	2.4	<i>n.s.</i>		
label ns	-	3	3	<i>n.s.</i>	-	.8	.8	<i>n.s.</i>		
buttons l	13	>	9	11	<.10	3.2	>	2.0	2.6	<.05
buttons r	14	<	19	16	<.05	3.5	<	5.1	4.3	<.05
button ns	-	2	2	<i>n.s.</i>	-	1.5	.9	<i>n.s.</i>		
total	117	123	116	<i>n.s.</i>	24.7	27.0	25.2	<i>n.s.</i>		

# Results

## Eye Tracking Data II: within first 10 transitions

	fixated at least once (%)		
target AOIs	CG	EG1	EG2
question	0	97	97
items	97	0	0
labels l	0	95	89
labels r	63	71	71
label ns	-	29	34
labels l+r (incl. ns)	63 (-)	68 (26)	63 (26)
buttons l	60	68	69
buttons r	37	42	49
buttons ns	-	5	6
buttons l+r (incl. ns)	20 (-)	24 (3)	34 (6)

→ Attention shift towards the right side of the scale in EG's

→ In general, low attention to the nonsubstantive option (EG1 < EG2);

particularly in EG1, increased risk of misinterpretation when not fixated at least once

# Results

## Eye Tracking Data IIIa: within first 10 transitions



Transitions from:	question			items		
to:	CG	EG1	EG2	CG	EG1	EG2
question	-	-	-	39	41	38
items	30	34	38	-	-	-
labels l	53	>	39 33	38	35	35
labels r	9	<	15 14	4	2	6
label ns	-		3 4	-	1	1
buttons l	7	9	8	11	17	12
buttons r	1	0	3	8	3	8
button ns	-	0	0	-	0	0
$n_{transitions}$	77	79	72	74	86	86

# Results

## Eye Tracking Data IIb: within first 10 transitions



Transitions from: to:	labels left			labels right			label ns		
	CG	EG1	EG2	CG	EG1	EG2	CG	EG1	EG2
question	33	26	27	21	26	19	-	9	38
items	25	35	37	36	11	16	-	9	0
labels l	-	-	-	14	9	10	-	9	0
labels r	20	15	23	-	-	-	-	64	23
label ns	-	4	0	-	14	29	-	-	-
buttons l	20	20	13	0	0	0	-	0	0
buttons r	2	1	0	29	37	26	-	0	31
button ns	-	0	0	-	3	0	-	9	8
$n_{transitions}$	85	81	60	28	35	31	-	11	13

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# Results

## Summary

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### Survey data revealed:

1. Providing a nonsubstantive response option resulted in shifted means towards the right side of the response scale, particularly when there was no visual separation.
2. In addition, the proportion of nonsubstantive responses tended to be higher when there was no visual separation.

### Eye tracking data indicated:

1. Providing a nonsubstantive option drew respondent's attention to the right side of the response scale.
2. However, respondent's attention to the label of the nonsubstantive response option is low, with visual separation not increasing overall attention.
3. Visual separation may help provide guidance at first sight, increasing initial attention to the label of the nonsubstantive response option and encouraging successive processing of all response options.



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# Conclusions



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Survey and eye tracking data suggest that visual separation of a nonsubstantive response option

- a. may prevent respondents from misinterpreting a nonsubstantive response option as further substantive option, and
- b. may help mitigating shifts towards the right side of the response scale due to misinterpreting the visual midpoint as the conceptual one although this effect cannot be prevented completely.



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**Thank you.**

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