Repugnant Warnings, Addiction, and Rational Choice

Before: Smokers' Rational Lexicographic Preferences for Cigarette Package Warnings: A Discrete Choice Experiment with Eye Tracking

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TOPS

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Motivation

- Uruguay's anti-tobacco campaign, plain packaging.

- Prior experiment.

- Humans routinely make decisions in violation of the normative axioms of rationality, as seen in several experimental settings (Tversky 1972, Tversky and Simonson 1993, Hey 2001, Rooderkerk, Van Heerde, and Bijmolt 2011, Trueblood et al. 2013, Agranov and Ortoleva 2017).

- Aversive stimuli and negative emotions interfere with rational decision-making (Leith and Baumeister 1996, Luce 1998, Bechara et al. 1999, Lerner, Small, and Loewenstein 2004, De Martino et al. 2006, Hewig et al. 2011, Guclu et al. 2012).

Motivation

- Prior economic research on rational addiction has focused mostly on the smoker's ability to make farsighted rather than myopic utility-maximizing consumption choices (Gruber and Koszegi 2001).

- A cigarette smoker could still make rational decisions within the confines of his addiction (Becker and Murphy 1988).

- Role of addiction in economic behavior. It is important to consider other strategies when making anti-smoking policy.

- Study how smokers choose, instead of how they should if they behave rationally.

What we do

- Smokers made binary choices between experimental cigarette packages with varying –mostly repulsive- warnings and background colors (plain packaging).

- Decide which of the two packages contained the cigarettes less risky for his health.

- Test whether smokers, confronted with repugnant and threatening experimental warnings, could still make choices that adhered to the classic axioms of rational choice.

- We supplemented our observations on smokers' choices with data on their eye movements.

- Semi-Structured Interview.

Plain packaging

- Homogenous packaging
- Removal of branding
- 80% warning

What we find

- We expected that smokers, exposed to repugnant and threatening images, would make noisy decisions. But we observed the opposite. The vast majority made stable choices.

- Participants universally made choices consistent with a complete, transitive and context independent preference ordering. We find little evidence of inconsistent choices.

- In a majority of smokers, we find strong evidence of the use of a noise reducing lexicographic decision rule to assess the riskiness of a cigarette package.

- Our findings support a model in which addiction permits the smoker to suppress aversive stimuli and negative emotions that would otherwise interfere with short-term rational decision making.

Experimental task

- 12 choice sets shown on a computer monitor images of two cigarette packs, varying in warning and color.

- For each set the participant was asked to click his mouse pointer on the cigarette pack that was “less risky for your health”. Forced-choice design.

- During the task, the Tobii T60 eye tracker noninvasively recorded participants’ eye movements

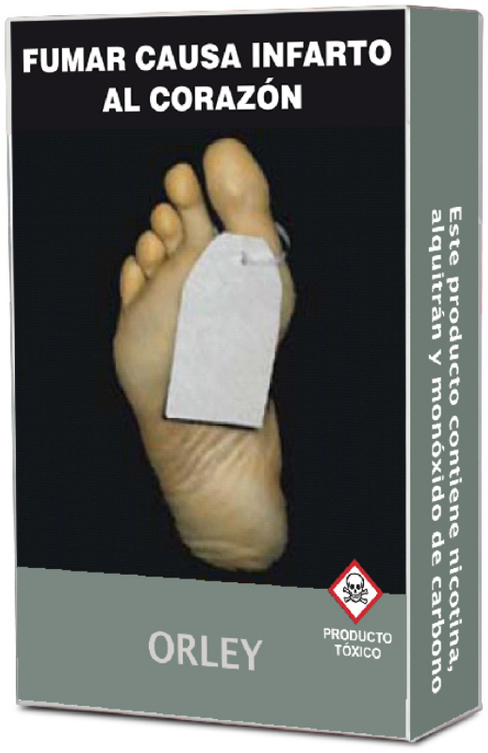
- 2 groups. Randomized sequential order and right-left orientation for each choice set.

- 98 smokers aged 19–60 years from the students, faculty and staff of the Universidad de la República in Montevideo, Uruguay

- Restrospective think-aloud task

Descriptive Statistics for 97 Study Participants	
Variable	Mean
Female (%)	59.8
Age (years)	28.2
Education attained:	
Some high school (%)	1.0
Completed high school (%)	1.0
Technical education (%)	6.2
Some university (%)	75.3
Graduated university (%)	8.3
Graduate study (%)	8.3
Cigarettes smoked per day:	
1–10 (%)	44.3
11–20 (%)	40.2
21–30 (%)	10.3
More than 30 (%)	5.2
First cigarette on arising 0-60 in a.m. (%):	60.2
Tried seriously to quit during past year (%)	28.9
Believes that smoking causes lung cancer (%)	93.8
Believes that smoking causes heart disease (%)	90.7
Believes that smoking causes syphilis (%)	14.4

Example of a choice set



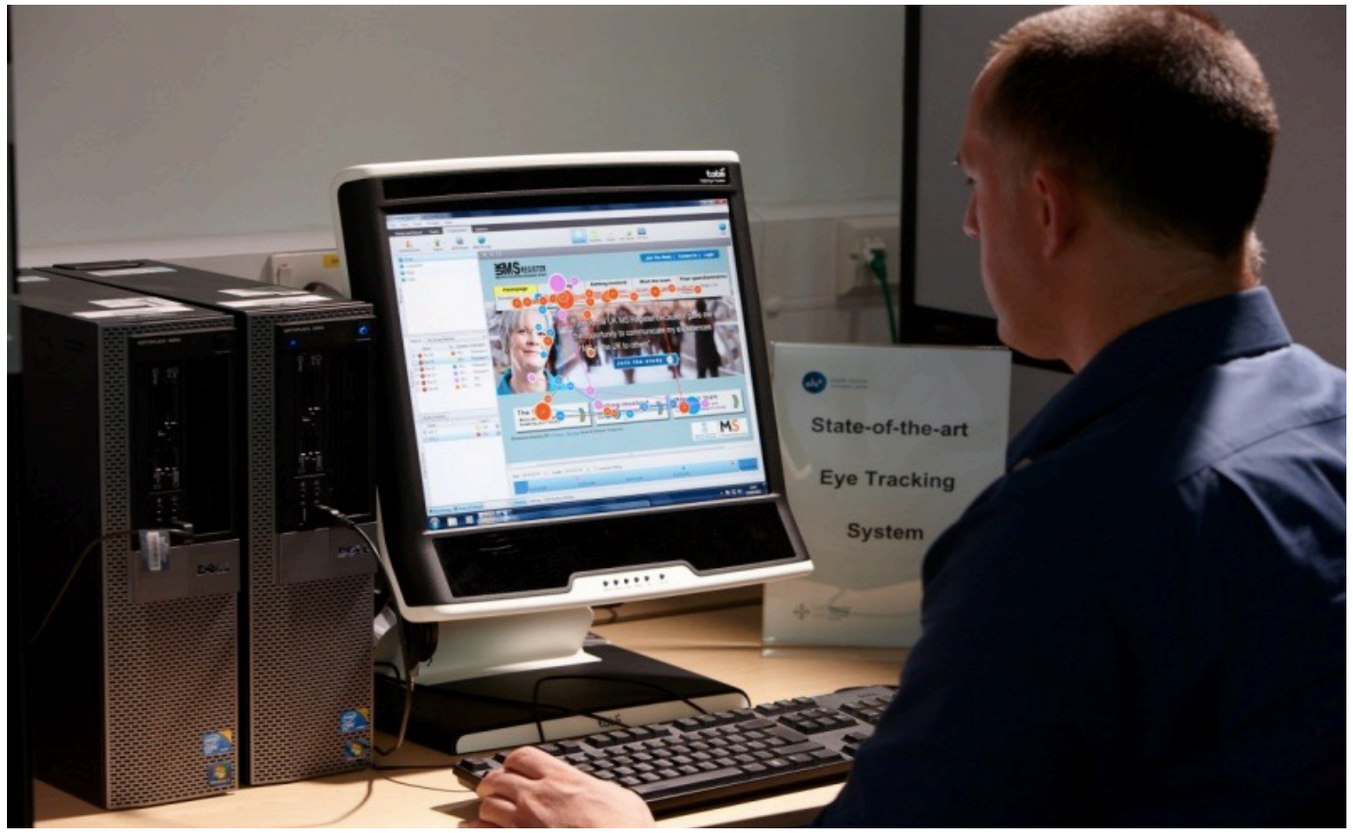
Eye tracking

- Non-invasive tracking of the eyes, recording trajectories and times where the eyes stop.

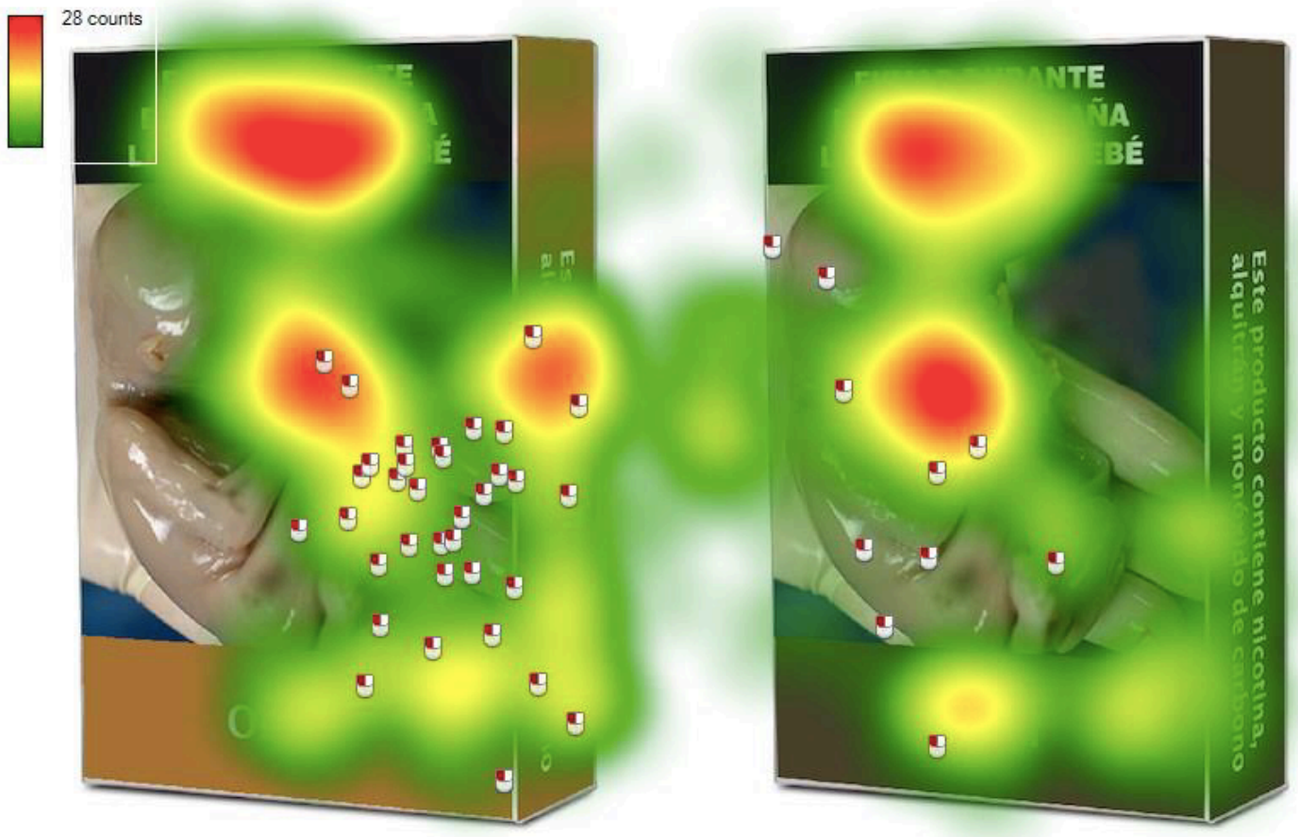
- Useful information for understanding economic decisions (Lahey & Oxley, 2016; Hermens et al., 2013; Wade & Tatler, 2005).

- Cheap, easy and short duration.

- As an attention measure, it helps to understand how visual information is processed.



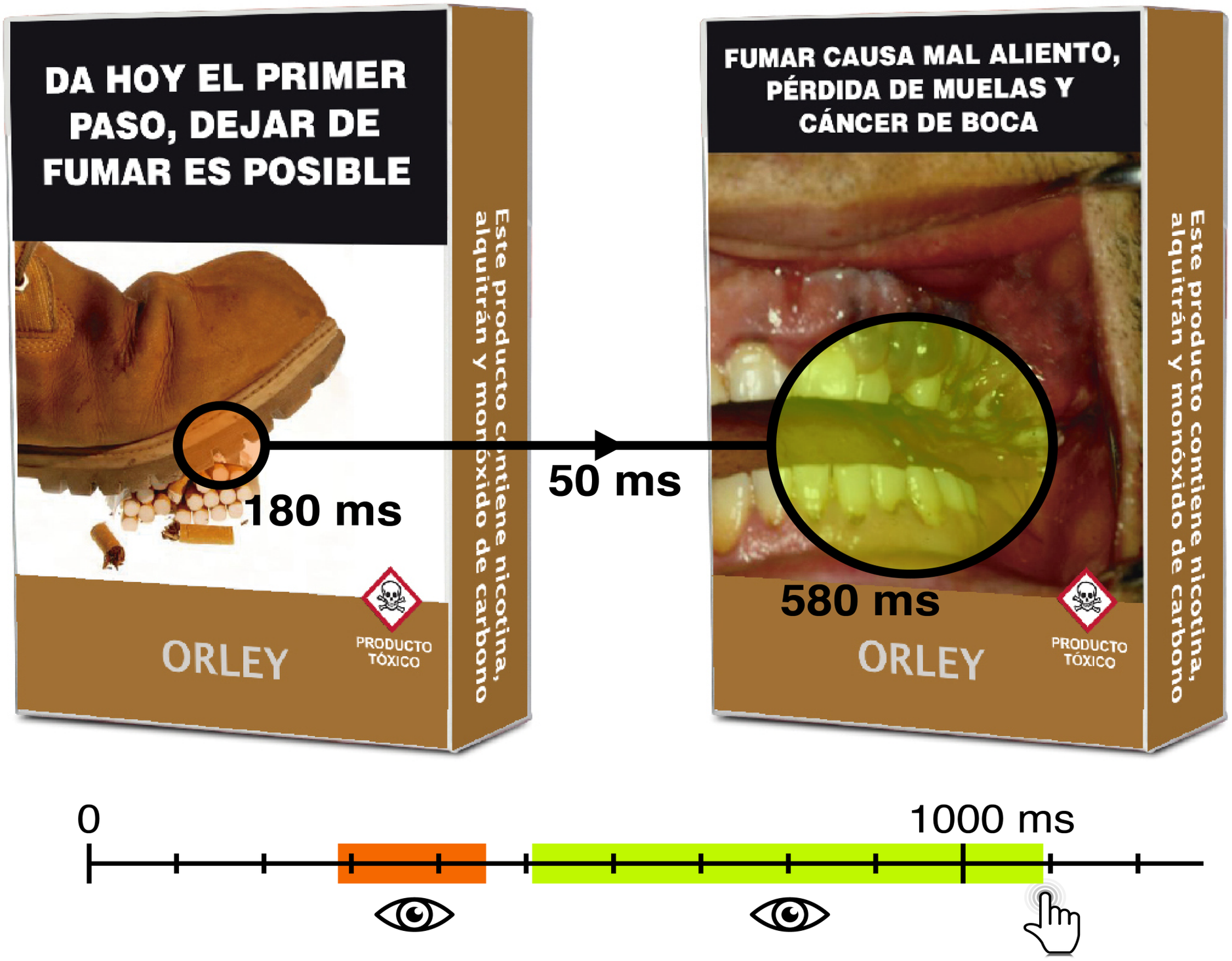
Participant filter: All



Eye Tracking
Areas of Fixation

X

ET data acquisition process



Theory (i)

Objects of choice: packages consisting in Warnings (W) and Background color (B)

$W = \{Boot, Cadaver, Fetus, Mouth\}$;

$B = \{Grey, Light\ Brown, Dark\ Brown\}$

$X = W \times B$ packages ; W, B, X finite

Binary choice set $S = \{x, x'\}$ con $x \neq x'$

Theory (ii)

- Context-independence: confronted with the same $S = \{x, x'\}$ at different points, consistently choose x over x'.

- Possible contextual elements: position (right-left) and order (leanrning and fatigue) .

- Transitivity

Theory (iii)

Additive utility: $u: X \to \mathbb{R}$; $u_B: B \to \mathbb{R}$; $u_W: W \to \mathbb{R}$

$$u(x) = u(w, b) = u_w(w) + u_B(b)$$

Additive utility allows compensatory decision making:

If $(u_B(b) - u_B(b')) + (u_W(w) - u_W(w')) > 0$ choose x over x'

Theory (iv)

Lexicographic:

$u(x) \geq u(x')$ if $u_w(w) \geq u_w(w')$ or
$u_w(w) = u_w(w')$ and $u_B(b) \geq u_B(b')$

Is non compensatory.

A lexicographic rule is a *noise reducing heuristic.*

Can include ordering and positioning effects (context-dependent preferences).

Results

Test	Choice Sets	Package on Left	Package on Right	Condition	*N**
1	E	Mouth, Gray	Boot, Dark Brown	Context Independence	93
	K	Boot, Dark Brown	Mouth, Gray		
2	A	Cadaver, Dark Brown	Mouth, Dark Brown	Transitivity, Additive utility	97
	C	Boot, Light Brown	Cadaver, Light Brown		
	J	Mouth, Light Brown	Boot, Light Brown		
3	A	Mouth, Dark Brown	Cadaver, Dark Brown	Lexicographic utility	89
	I	Cadaver, Gray	Mouth, Dark Brown		
4	E	Mouth, Gray	Boot, Dark Brown	Lexicographic utility	88
	J	Boot, Light Brown	Mouth, Light Brown		
	K	Boot, Dark Brown	Mouth, Gray		
	L	Mouth, Dark Brown	Boot, Gray		
5	C	Boot, Light Brown	Cadaver, Light Brown	Transitivity, lexicographic utility	91
	D	Fetus, Light Brown	Cadaver, Gray		
	F	Boot, Gray	Fetus, Gray		
6	B	Fetus, Dark Brown	Fetus, Light Brown	Lexicographic utility	77
	G	Cadaver, Light Brown	Cadaver, Dark Brown		
1–6					63

**N* = Number of participants whose choices satisfied each specific test. There were 97 total participants. A total of 63 participants satisfied all 6 tests.

Results- Parametric model

Additive utility

$$u_W(w) + u_B(b) + u_M(m) + u_N(n)$$

$u_m(m)$ with $m \in M = \{Left, Right\}$

$u_n(n)$ with $n \in N = \{1, \ldots, 12\}$

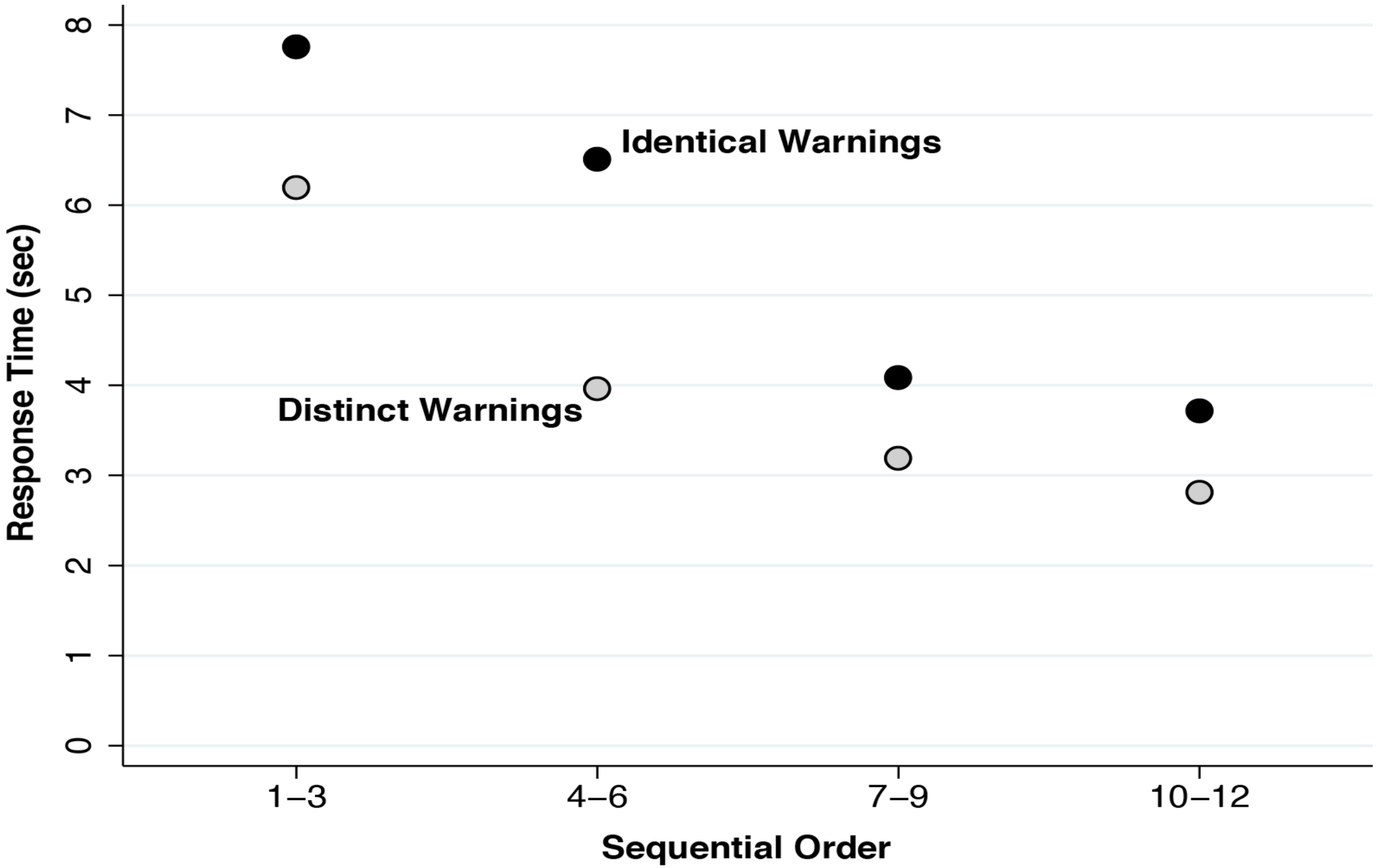
TABLE 3. CONDITIONAL LOGIT REGRESSION ESTIMATES*

Independent variable	Model 1	Model 2	Model 3
Cadaver	–1.096 (0.177)	–1.112 (0.174)	–1.332 (0.175)
Fetus	–2.711 (0.266)		
Mouth	–2.864 (0.162)		
Fetus or Mouth		–2.835 (0.152)	–2.752 (0.149)
Light Brown	0.707 (0.178)	0.745 (0.164)	
Dark Brown	–0.507 (0.139)	–0.490 (0.134)	–0.825 (0.110)
Right Side	0.209 (0.082)	0.209 (0.082)	0.201 (0.081)
Q Statistic§	–1.061 (0.283)	–0.124 (0.224)	0.507 (0.141)

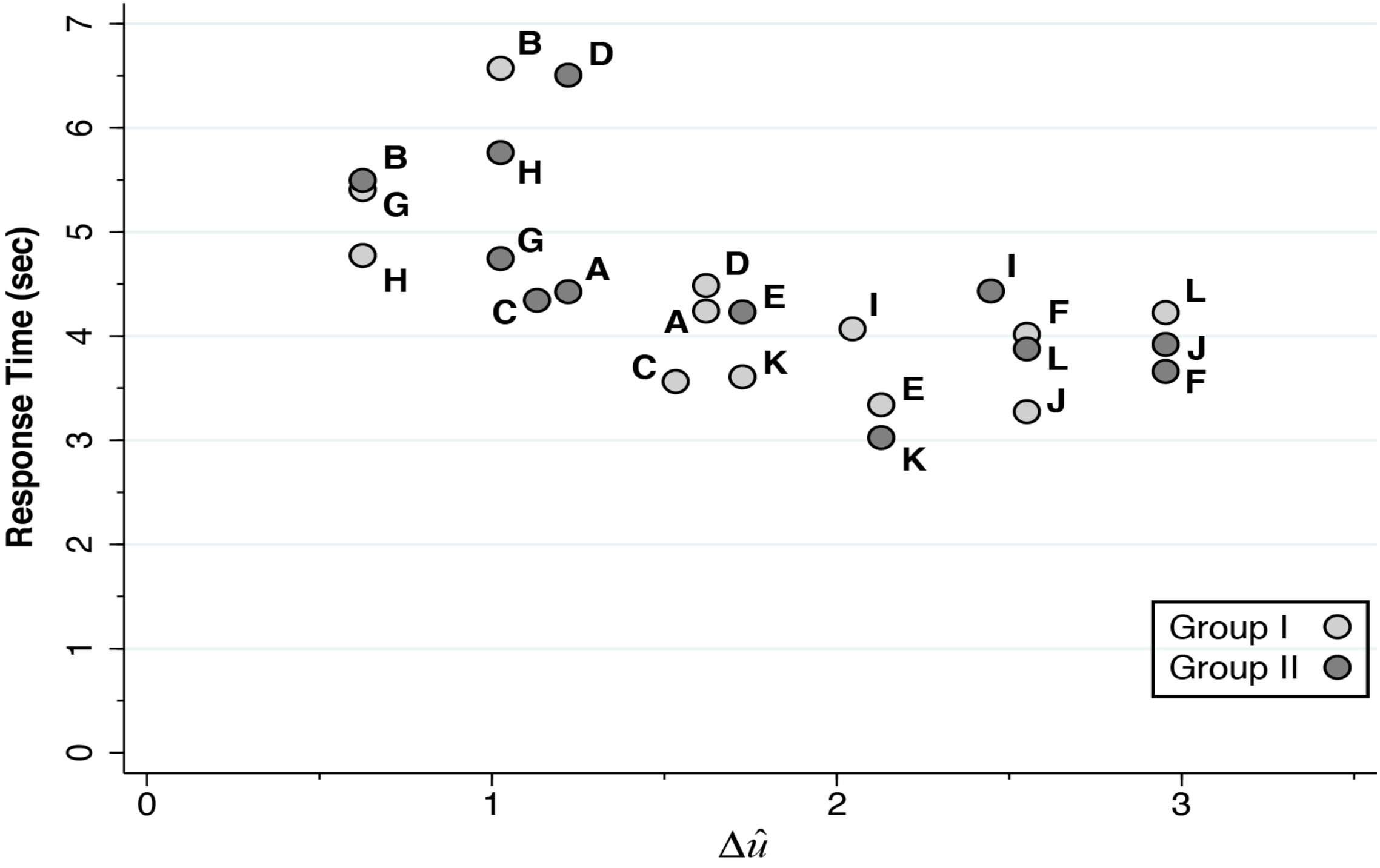
*All models had 1,164 (12x97) observations on 97 participants

§ $$Q = \min_{w,\, w' \in W} \operatorname{abs}\left(\hat{u}_W\left(w\right) - \hat{u}_W\left(w'\right)\right) - \max_{b,\, b' \in B} \operatorname{abs}\left(\hat{u}_B\left(b\right) - \hat{u}_B\left(b'\right)\right)$$

Response time

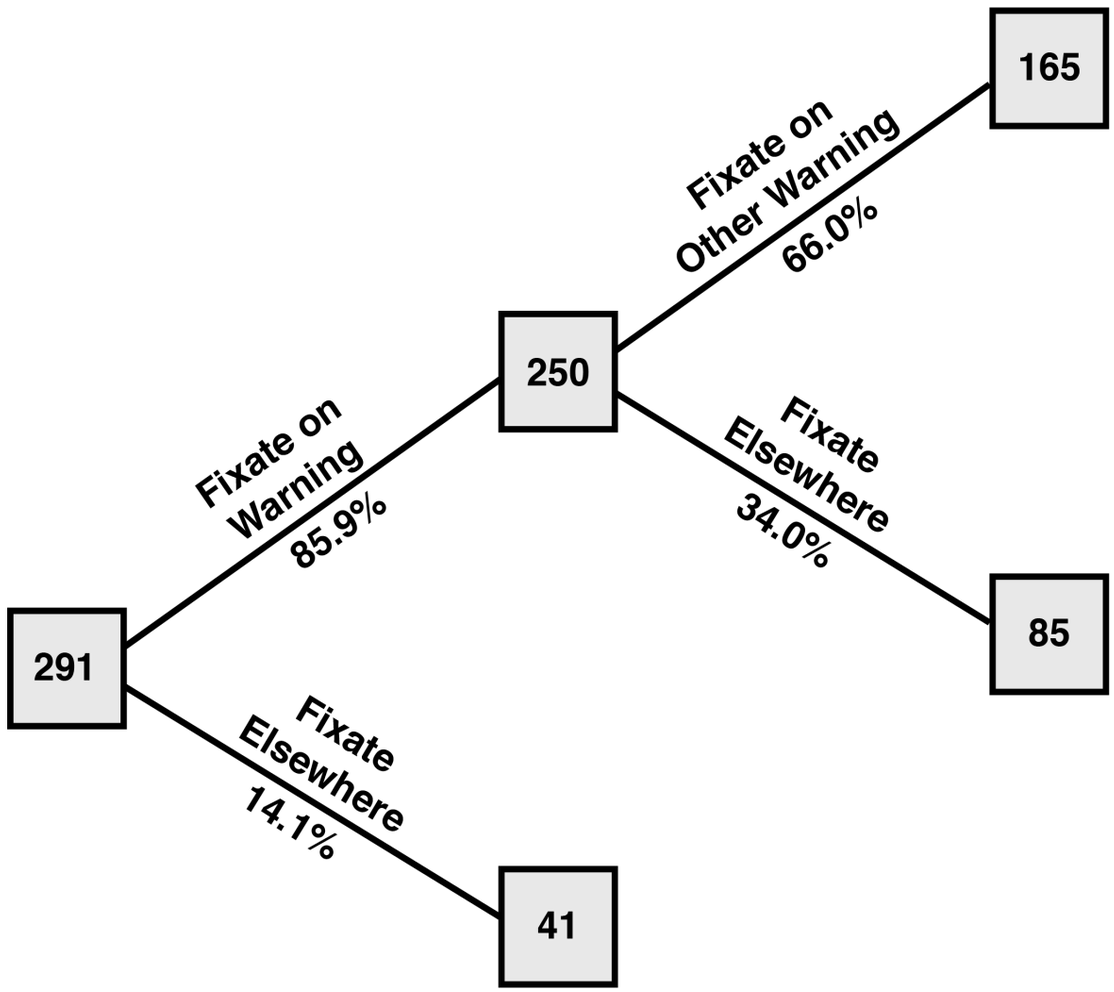


Mean Response Time in Relation to Sequential Order and the Presence or Absence of Identical Package Warnings in the Choice Set

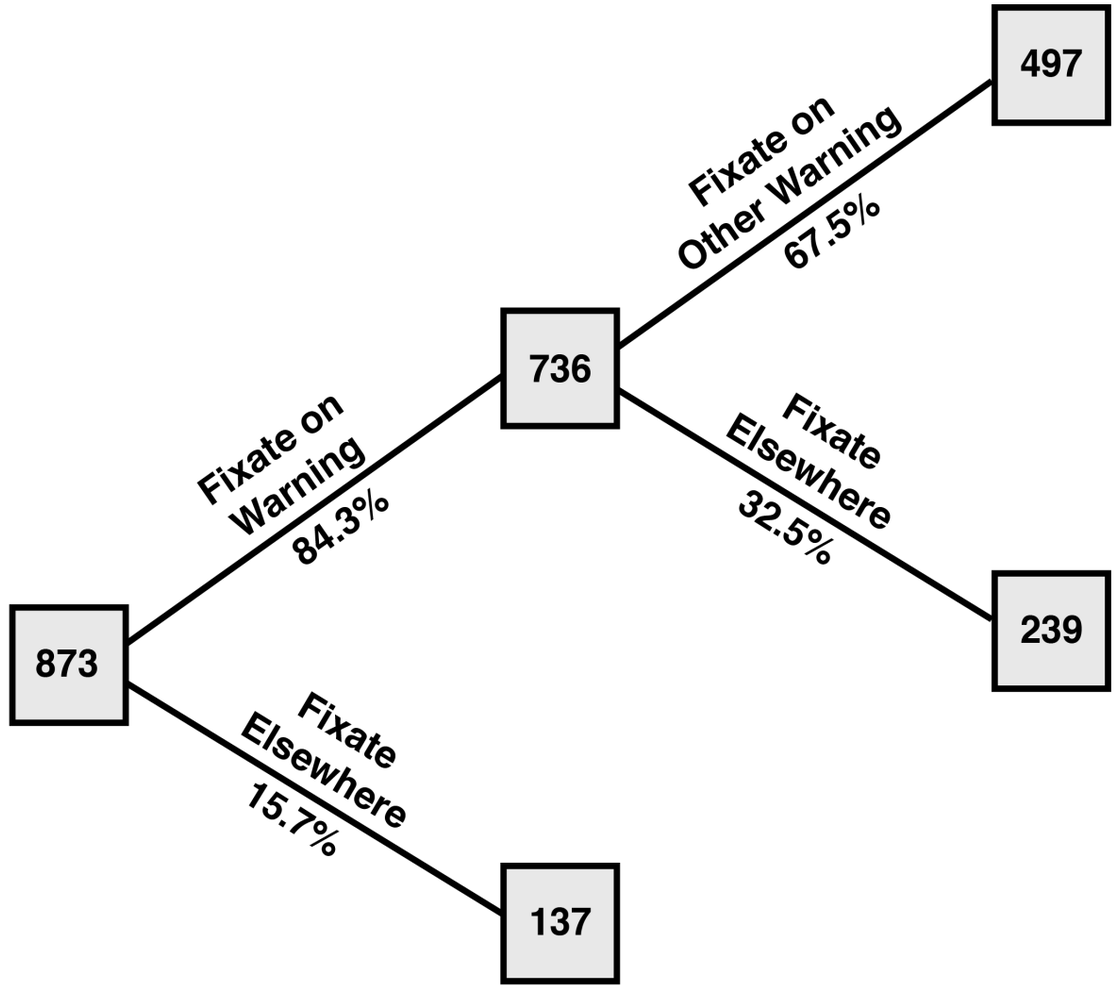


Relation Between Mean Response Time and Estimated Divergence in Utility Among 12 Choice Sets in Each of the Two Groups

Eye tracking search patterns

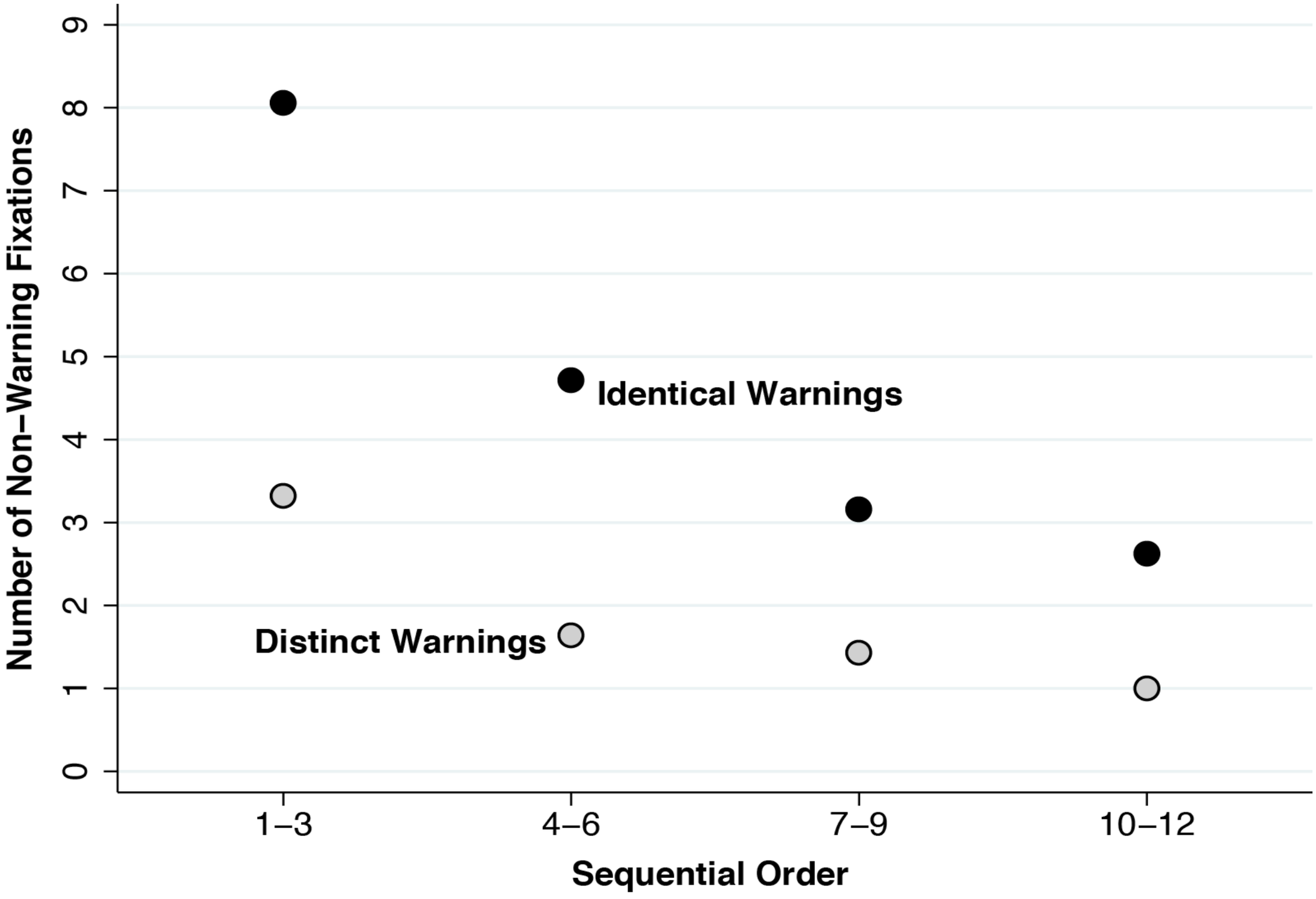


Identical Warnings



Distinct Warnings

Eye tracking



MEAN NUMBER OF FIXATIONS OUTSIDE WARNINGS IN RELATION TO SEQUENTIAL ORDER AND THE PRESENCE OR ABSENCE OF IDENTICAL PACKAGE WARNINGS IN THE CHOICE SET

Violators vs non-violators

- 64,9% passed all 6 tests of additive/lexicographic utility (non-violators)

- Violators:
  - had longer response time and more fixations
  - Positioning effect

What we find

- Nearly all participants made choices that satisfied rational choice, including context independence and transitivity.

- Most appear to use a lexiocgraphic rule as a noise-reducing heuristic.

- Eye tracking: sequence of eye fixations consistent with a lexicographic choice strategy

- “Violators” smoke less and made noisier decisions (longer response times, right side bias, more fixations)

- “Non-Violators” better able to block averisve stimuli and make a rational choice

How Can Addicted Smokers Be Rational?

- Within the strict confines of their addiction, they acted rationally.

- it is a demonstration that addiction induces the decision-maker to selectively ignore aversive stimuli in order to make narrow decisions that, at least superficially, adhere to the axioms of rationality.

- Results consistent with a Drift Diffusion Model

- It is necessary to think about models of addiction involving two potentially conflicting internal decision-making pathways (Schelling 1978; Thaler and Schefrin 1981; Bernheim and Rangel, 2004)

Where do we go from here?

- Study the relative importance of fixations on image versus text.
- Learning and fatigue
- Relation between fixations and preferences: top-down vs. bottom-up control. Do preferences drive fixations or is it the other way? Further elucidate the eye-mind link
- Deepen the addiction-choice relation
- Working on the results of a new experiment now