Motivation and Background

Much cognitive psychology literature (Winkler, 1968; Hogarth, 1975, Edwards, 1985) focuses on how people update beliefs over time and examines belief updating in different domains (Moorthy, Ratchford, & Tabulak, 1997). Fewer investigations have looked into how people form mental representations prior to any belief updating, which is when their uncertainty about a domain is at its maximum.

In this research, we investigate:

Q1: How does the mental distribution look like when people consider a variable about which they possess little knowledge?

• The bell curve. Winkler (1967) postulate that people tend to generate a normal distribution for any variable they encounter
• The flat line. Fox and Cleman (2005) suggest that people have “ignorant prior” and generate uniform distribution when they have limited knowledge

Q2: How does this distribution evolve with knowledge?

These questions have theoretical significance to Bayesian models of information updating, as the original mental distribution can determine subsequent prediction functions and model performance (Griffiths & Tenenbaum, 2006).

Hypotheses

H1: People intuit a uniform distribution when they possess little knowledge about the variable

H2: Once people have a general idea (not actual specific knowledge) about that variable, they generate a distribution that is less flat and more bell-shaped, even though the actual distribution is either a bell curve or a flat line

Experimental Designs

Exp 1: Various Life Scenarios (M Turk, N = 387), Test H1

Task: read 6 scenarios out of 12 scenarios and allocate a certain number of items into several bins

Exp 2: Song Length (M Turk, N = 481), Test H2, Pre-registered

IV: familiarity of song length (3 between-subjects conditions)
Haidt’s Symphony (unfamiliar)
Beatles (familiar)
Hog (familiar)

Feature: controlling for actual distributions (as normal distributions)

Exp 3: Credit Score (M Turk, N = 387), Test H2, Pre-registered

IV: actual distribution (3 between-subjects conditions)
young age (monotonously sloping down)
middle age (U-shaped)
old age (monotonously sloping up)

Feature: incentivizing response accuracy

In Exp 4 (not reported here), we also rule out the explanation that participants were mindlessly drawing flat distributions.

Data Analyses

Main Dependent Variable: Kurtosis of each individual’s distribution

Kurtosis is the 4th central moment of a distribution. It measures the “tailedness” of a distribution. The kurtosis of any univariate normal distribution is 3, and distributions with kurtosis smaller than 3 (low peak; thinner tails) are named platykurtic while kurtosis larger than 3 (higher peak; fatter tails) are leptokurtic.

Why kurtosis? Higher moments of the distribution better describes the shape of the distribution. In showing difference in kurtosis, we argue that participants’ intuitive distribution which are not Gaussian shaped with larger variance, but a different shape that should be simulated or approximated in a different way.

Exp 1: We calculated the kurtosis for each participant’s elicited distribution for each scenario, and used t-test to compare the mean kurtosis for each scenario against uniform (kurt = 1.8) and normal (kurt = 3). All scenarios reject uniform distribution. Most scenarios show smaller than 3 kurtosis (platykurtic).

Exp 2: Mean kurtosis is 4.08 for the Hit song condition, 4.55 for the Beatles song condition and 2.32 for the Symphony condition. The difference between Hit & Symphony and Beatles & Symphony is significant (t = 8.27 and 3.92, p < 0.001), while the difference between Hit and Beatles is not significant (t = 0.81, p = .42).

Exp 3: The average kurtosis for each condition is not different from each other (kur = 2.47 ± 2.52, 2.64 for Young, Middle and Old respectively, all n.s.). All elicited distribution were different from actual distribution: Young: t = 15.40, p < .001; Middle: t = 2.63, p < .05; Old: t = 7.22 (elicited is less peaked), p < .001.

Directions

• Show that such belief is not restricted to the distribution elicitation method.
• Ongoing Lab Study: participants allocate items one by one.
• Investigate the behavioral consequences that emerge from the belief.
• Estimate properly shaped prior distribution and simulate posterior belief distribution from the estimation. Test if the simulated posterior is descriptive of people’s actual judged posterior.

References


Please Direct Your Comments and Questions Regarding the Project to: lifei@chicagobooth.edu