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Why do we overestimate others' willingness to pay?

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Abstract

People typically overestimate how much others are prepared to pay for consumer goods and services. We investigated the extent to which latent beliefs about others' affluence contribute to this overestimation. In Studies 1, 2a, and 2b we found that participants, on average, judge the other people taking part in the study to "have more money" and "have more disposable income" than themselves. The extent of these beliefs positively correlated with the overestimation of willingness to pay (WTP). Study 3 shows that the link between income-beliefs and WTP is causal, and Studies 4, 5a, and 5b show that it holds in a between-group design with a real financial transaction and is unaffected by accuracy incentives. Study 6 examines estimates of others' income in more detail and, in conjunction with the earlier studies, indicates that participants' reported beliefs about others' affluence depend upon the framing of the question. Together, the data indicate that individual differences in the overestimation effect are partly due to differing affluence-beliefs, and that an overall affluence-estimation bias may contribute to the net tendency to overestimate other people's willingness to pay.

Keywords: willingness to pay, wealth-beliefs, overestimation, better-than-average effect.

1 Introduction

Price-setting, negotiation, public goods games, proxy decision-making, and bidding in many types of auction are all situations in which people's behaviour is likely to be based, in part, on an estimate of how much other people are prepared to pay for something. Recent work indicates a widespread tendency to overestimate others' willingness to pay (other-WTP), and that this bias has no single cause. The present work provides a new perspective by examining the contribution of latent beliefs about other people's affluence to estimates of their willingness to pay.

1.1 Overestimating others' willingness to pay

People systematically overestimate others' willingness to pay. Preliminary evidence came from van Boven, Dunning & Loewenstein (2000), who found that sellers endowed with a product over-estimated the amount that buyers were prepared to pay for it. More recently, Kurt and Inman (2013) found that buyers overestimate the amount offered by other buyers.

These findings are just one instance of a much more general result, comprehensively established by Frederick (2012). In a first demonstration, marketing students entered private bids for 10 products sold via auction (Vickrey, 1961), prior to estimating the median bid for each item. On average, estimates were 40% higher than the true medians. This effect was robust across various procedural changes, including: (a) giving incentives for accurate estimates, (b) asking people to estimate the proportion of other participants who would pay more (or less) than they would, (c) having people state their the maximum WTP and estimate that of the next (or preceding person) participant, or of a named acquaintance, (d) indicating whether they would pay more or less than "the typical person taking part", and (e) estimating the arithmetic mean of bids in a Becker-DeGroot-Marschak (BDM) auction (Becker, DeGroot & Marschak, 1964). However, the effect was found to be specific to estimates of WTP, with no such overestimation of other people's maximum selling prices; and it is specifically monetary, with no self-other differences in the number of pencils that a person would be prepared to sharpen in order to earn the product.

Notably, most of this work involved an implicit or explicit comparison with one's own willingness to pay (self-WTP), so that the overestimation of WTP manifests as the belief, on average, among a group of people that the other members would pay more than oneself: a self-other WTP gap. This gap has also recently been found in studies where the payment is completely at the buyer's discretion and the good or service is received regardless of the paid amount. Jung, Nelson, Gneezy and Gneezy (2014) gave participants a University mug, telling them "the mug is yours" before giving them the option to pay for it. Participants on average estimated that the previous and next participants would pay more than they did. In addition, some participants were in-

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vited to "pay what you want" whereas others were told that the mug "was paid for by the participant before you" (so that they would be paying for the next person). The latter framing elicited higher payments, mediated by an increase in estimates of how much others would be paying – indicating an important role for the (over)estimation of other-WTP in the causal chain between price-framing and consumer decisions.

1.2 Possible explanations for the overestimation effect

Frederick (2012) tested and dismissed several explanations for the overestimation effect. First, it does not seem to be due to people using market price as the basis for their other-WTP judgments, because the overestimation held for imaginary goods. Second, judgments of whether the typical participant would like the products more or less than oneself indicated no bias, even while participants judged that such a person would pay more, so differences in perceived-liking are unlikely to be responsible for the WTP gap. Third, although participants on average reported that spending money was more painful for them than for others, this did not predict the size of the self-other WTP discrepancy, arguing against an "empathy gap" explanation (van Boven et al., 2000). Fourth, although people often report being above average on desirable traits (the "better than average" effect; e.g., Brown, 2012), it is not clear that being less prepared to pay for a product is desirable; moreover, making more money from a sale presumably is desirable, but there was no self-other gap for selling prices. A fifth possibility is that the products were generally undesirable: if people know that they do not value the product but are unsure about other people, they may conclude that they value it less than average (analogous to the belief that one is below average on a difficult task; Krueger, 1999; Moore & Cain, 2007). However, the effect never reversed in the way that this account would predict for highly-prized products. Finally, Frederick rejected the idea that, because other people are represented at a more abstract level than oneself (Trope & Lieberman, 2003), "low level" considerations such as budget and space limits are more prominent for oneself than for others; the WTP gap was large irrespective of whether the other was cast in abstract or concrete terms, and unaffected by shifting the transaction outcomes into the future – which ought to have raised the "construal level".

The over-estimation of others' willingness to pay is therefore likely to be multiply-determined – so much so that Frederick (2012) labelled it "the X effect". One remaining possibility is that the effect partly results from beliefs about other people's financial circumstances. Broadly: people may overestimate others' willingness to pay because they overestimate their *ability* to pay. The current work explores this possibility.

1.3 The role of affluence-beliefs

Our primary interest concerns people's beliefs about the financial resources that others have available to spend on goods and services; we use the label *affluence* to refer to this ability to pay for products. No easily-reported economic measure fully captures this construct. Wealth, for example, includes the value of a person's possessions and assets, whereas income captures monetary influx but not existing cash reserves or fixed expenditures – and both measures ignore access to credit. Given this complexity, our studies probe affluence-beliefs in various ways, primarily focusing on measures of income that are likely to be correlated with spending power, psychologically as well as ecologically.

Our studies address three related questions. First, is the WTP overestimation documented by Frederick (2012) robust and general? Although Frederick's studies were very comprehensive and consistent, it is worth checking that the core effect generalizes to other labs, samples, and procedures (e.g., Francis, Tanzman & Matthews, 2015; Open Science Collaboration, 2015).

Second, do beliefs about other people's affluence underlie beliefs about their willingness to pay? Intuition suggests that richer people will be prepared to pay more. We discuss the possible origins of such a generalization, as well as the question of whether it is valid, in the General Discussion; for now we simply note that if people hold the lay-theory that affluence (the ability to pay) predicts willingness to pay then different latent beliefs about the wealth of others will partly underlie differences in the overestimation of other-WTP.

The third question is whether affluence-beliefs contribute to the *overall* tendency to overestimate other-WTP (i.e., the mean overestimation effect across participants). If there is a positive relationship between estimated affluence and estimated WTP, net overestimation of the former will create or enhance overestimation of the latter (or reduce a tendency to underestimate, although underestimation has never been observed).

The work surveyed above provides little direct evidence regarding the role of affluence beliefs in the overestimation effect. In two Appendices, Frederick (2012) reported the results of asking people to indicate their relative standing "compared to others taking the survey today" on a scale from –5 (much less than average) to +5 (much more than average) for a wide range of measures, including "how wealthy are you?" One study (N=104) found a mean response of –0.98 and a correlation with the overestimation effect of –0.09; the other (N=242) a mean response of –0.21 and a correlation of –0.11. These correlations were not flagged as statistically significant, or discussed, but both the means and correlations are in the direction predicted by the idea that a latent belief that others are wealthier than oneself may contribute to the overestimation of others' willingness to pay.

In addition, a broad body of work gives reason for thinking that people may often over-estimate the wealth of others. First, affluent individuals are often highly-conspicuous (e.g., through media depictions), and this availability is likely to lead to overestimations of "typical" wealth – akin to the overestimated frequency of exotic causes of death (e.g., Plous, 1993). Second, upward social comparisons are more prevalent than downward comparisons (e.g., Buunk, Zurriaga, Gonzalez-Roma & Subirats, 2003), perhaps as part of a general directional construal of relative magnitudes (Matthews & Dylman, 2014). Psychological and econometric studies suggest that people typically compare themselves with others who are similar to them (Wood, 1989), and that upward income comparisons are more common/more highly weighted than downward ones (e.g., Boyce, Brown & Moore, 2010; Clark & Senik, 2010). Upward comparisons may imply a preoccupation with the idea that similar others are better off than oneself, and/or increase the availability of more affluent exemplars when estimating the wealth of a "typical other" – in turn contributing to a net overestimation of their willingness to pay.

In summary, we investigate the robustness of the other-WTP overestimation effect and probe whether individual differences in the effect are partly due to differences in beliefs about others' affluence. We also examine whether overestimation of others' affluence is typical, in a way that could partly account for the net overestimation of others' willingness to pay.

1.4 Overview of studies

We report 6 studies that examine the link between affluence-beliefs and WTP estimates. Studies 1, 2a and 2b use a range of products and procedures to investigate beliefs about other people's affluence and willingness to pay for consumer products, focusing on the self-other WTP gap. Study 3 seeks evidence for a causal link between affluence-beliefs and beliefs about WTP. Studies 4, 5a, and 5b use a between-participant design in which people estimate the WTP of a separate group of participants engaged in a "real" financial transaction, and examines order and incentive effects. Study 6 probes the accuracy of beliefs about other people's affluence in more detail.

2 Study 1

Participants indicated the proportion of people taking part in the survey who have more or less money than themselves; they then indicated whether the amount that they would be prepared to pay for each of 10 products was more or less than what the typical person would pay.

Table 1: Proportion of participants who indicated that the "typical participant" would pay more than they would for each product in Study 1.

Product	P(other > self)
A freshly-squeezed glass of apple juice	.695
A Parker ballpoint pen	.863
A pair of Bose noise-cancelling headphones	.705
A voucher giving dinner for two at Applebee's	.853
A 16 Oz jar of Planters dry-roasted peanuts	.774
A one-month movie pass	.800
An Ikea desk lamp	.863
A Casio digital watch	.900
A large, ripe pineapple	.674
A handmade wooden chess set	.732

Note: All binomial test p-values $< .001$.

2.1 Method

2.1.1 Participants

Participants took part on-line and were recruited via Amazon's Mechanical Turk (MTurk). Here and throughout, respondents who were underage or did not complete the task were removed from the data set, and only the first occurrence of each ip address was included to help ensure data independence (ips that overlapped in time were both excluded; e.g., Matthews, 2012; all exclusions were prior to analysis). The final dataset comprised 190 participants (71 female) aged 18–67 ($M = 31.7$, $SD = 9.1$).

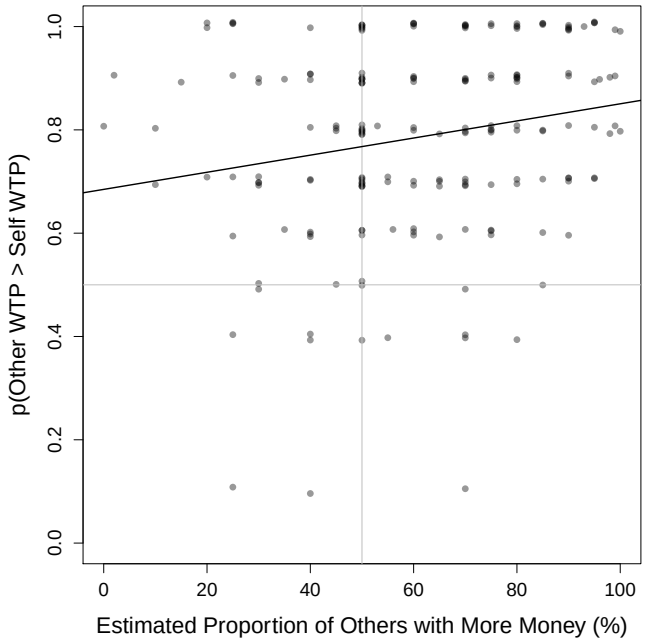
2.1.2 Design and procedure

After initial instructions, participants were randomly assigned either to "estimate the proportion of people taking part in the survey who have more money than you do" ($n = 97$) or the proportion who "have less money than you do" ($n = 93$), and typed their estimate in a text box. Responses to the "less than" version were subtracted from 100 to give the implied percentage of other people believed to have more money than the participant.

The next webpage presented a list of 10 products (Table 1). For each, the participant indicated whether the amount they would be willing to pay is more or less than what "the typical person taking this survey today would be willing to pay" (product order and left-right assignment of the "less" and "more" response options were randomized).

A subsequent page asked for demographic information: age, gender, and annual pre-tax household income with 8 categorical options: Less than $15,000; $15,001–$25,000; $25,001–$35,000; $35,001–$50,000; $50,001–

Figure 1: Results of Study 1. The plot shows the proportion of products for which the participant judged that the typical participant would pay more than they would against the participant's estimate of the percentage of others who have more money than they do. y-axis values have been jittered to reduce overplotting.



$75,000; $75,001–$100,000; $100,001–$150,000; greater than $150,000 (e.g., Kraus, Adler & Chen, 2013). Income responses were converted into estimates of absolute income using a median-based Pareto-curve estimator (Parker & Fenwick, 1983).[1]. These demographic control variables were included in all studies.

2.2 Results and discussion

Figure 1 provides a simple illustration of the data by plotting the proportion of products for which the participant judged that other people would pay more against the participant's estimate of the proportion of participants who have more money than them. The figure illustrates three core findings.

First, participants judged that others would pay more for a majority of products (the data cluster in the top half of the plot). Table 1 confirms that, for every product, the majority of participants believed that others would pay more than they would.

Second, participants typically judged their own wealth to be below that of most other participants (the data cluster in the right-hand side of the plot). Specifically, 57.3% of participants believed that they had less money than the median; only 22.6% judged that they had more. Participants on average believed that 61.0% ($SD = 22.4\%$) of other people had more money than they did, (95% CI = 57.8%, 64.2%) $t(189) = 6.73$, $p < .001$. This result was unaffected by the wording of the relative wealth question ($M_{lessthan} = 62.9\%$, $SD = 22.8\%$; $M_{morethan} = 59.1\%$, $SD = 22.0\%$; $t(188) = 1.15$, $p = .250$).

Table 2: Fixed effects coefficients and 95% confidence intervals from mixed effects logistic regression for Study 1.

Predictor	Coef.	CI_{lower}	CI_{upper}	z	p
Intercept	1.483	1.126	1.841	8.13	<.001
c.PMORE	0.012	0.002	0.022	2.27	0.024
z.PHRASING	0.077	−0.122	0.275	0.76	0.450
z.PHRASING * c.PMORE	0.004	−0.004	0.012	0.97	0.331
z.INCOME	−0.126	−0.324	0.072	1.25	0.213
z.AGE	−0.039	−0.227	0.149	0.41	0.685
z.GENDER	0.149	−0.040	0.338	1.54	0.123

Third, the WTP gap was positively related to affluence judgments, as evinced by the upward-sloping regression line. To test this relationship formally, we used mixed effects logistic regression using the lme4 package (Bates, Mächler, Bolker, & Walker, 2015) for the R statistical language. The dependent variable was whether the participant believed that the typical person would be willing to pay more for the product (coded 1) or not (coded 0); the key predictor variable was PMORE, the participants' estimates of the proportion of other people with more money than them; we subtracted 50 from each value so that 0 implies the belief that an equal number of people are more/less affluent than oneself, and used this variable (labelled c.PMORE) in the analysis. We also included PHRASING (whether the participant estimated the proportion with less money or more money) and its interaction with c.PMORE. Age, Gender (0=Male 1=Female), and household income were included as control variables (after standardization by z-scoring). We included random intercepts for participants and products, and random slopes by product for the effect of c.PMORE (Barr, Levy, Scheepers & Tily, 2013). The fixed effects are reported in Table 2; participants with lower perceived relative wealth were more likely to judge other people as willing to pay more for the products; no other predictors are significant, apart from the intercept. The positive intercept means that participants who judged their own wealth to be at the median of the sample (and who were average on the control variables) believed that others would typically pay more than them.

[1]Denoting the lower bound of the open-ended (i.e., top) category X_i and the number of responses in this category as N_i, the value for the top category is $2^{1/v}X_i$, where $v = \frac{\ln(N_i+N_{i-1})-\ln(N_i)}{\ln(X_i)-\ln(X_{i-1})}$

How important is this effect? Using the regression parameter estimates, the odds of judging that the next person will pay more than oneself increase by approximately 14% when PMORE increases from 50% (the belief that one's own wealth is right in the middle of the sample distribution) to 61% (the mean response for this sample). Calculating effect sizes is non-trivial for mixed-effects logistic regression, but the simple correlation depicted in Figure 1 has $r = .200$: beliefs about the proportion of more affluent others accounts for about 4% of the variance in the WTP effect — a "small to medium" effect, as one might expect for such a multiply-determined and noisy outcome as stated/estimated WTP.[2] As noted in the Introduction, previous work in this area has largely established factors that do *not* contribute to the overestimation effect (Frederick, 2012), so finding a factor that makes even a modest contribution has some value.

In summary, participants tended to believe that the majority of other participants have more money than they do and that other participants would pay more for each product than they would. The strength of these two beliefs was positively related: affluence-beliefs accounted for individual differences in the WTP overestimation effect, and are likely to contribute to the net effect. However, the belief that others would pay more was not entirely due to the belief that they are more affluent.

3 Studies 2a and 2b

Studies 2a and 2b built on Study 1 by changing the way that people indicated their subjective relative discretionary income (SRDI), and having them actually state their WTP for various consumer products in dollars and cents before stating the WTP of other people. Studies 2a and 2b differed from one another only in the order of the tasks.

3.1 Method

3.1.1 Participants

For Study 2a participants were recruited via MTurk; those whose IDs/ip addresses occurred in Study 1 were excluded giving $N = 408$ (240 female, ages 18-75, $M = 37.4$, $SD = 12.1$) For Study 2b participants were recruited via the Crowdflower participant-recruitment platform (www.crowdflower.com/pricing) giving $N = 381$ (230 female, ages 18-70, $M = 36.9$, $SD = 12.1$).

[2]Even "obviously important" effects are often surprisingly small; see e.g., http://datacolada.org/2014/04/04/18-mturk-vs-the-lab-either-way-we-need-big-samples. As one illustration from that post: two studies that examined whether people who like eggs eat egg salad more often than people who do not yielded r values of .17 and .16: only about 2.7% of the variance in frequency of egg salad consumption was accounted for by liking/disliking eggs.

3.1.2 Design and procedure

In Study 2a, participants first indicated how their discretionary income ["the amount you have to spend as you wish after paying taxes and unavoidable outgoings (e.g., bills/mortgage/rent)"] compares with that of "the next person who will take this survey". As in Frederick (2012) this framing is a way of getting people to think of a specific individual who is representative of the other participants in the study. Participants made their judgments on a 9-point scale: "Mine is very much lower"; "Mine is much lower"; "Mine is somewhat lower"; "Mine is slightly lower"; "They are exactly the same"; "Mine is slightly higher"; . . . "Mine is very much higher". We coded these from +4 to –4, respectively, such that zero corresponded to equal affluence, and increasingly positive numbers correspond to a belief that the other person is progressively more affluent than oneself.

On the next page participants were asked to imagine that they are attending an auction for consumer products and that they would have to state the most that they would be willing to pay for the product prior to price revelation. (Full instructions for this and other studies using auction-type tasks are included in the Supplement.) Examples were used to show how under-stating or over-stating one's maximum willingness to pay would lead to sub-optimal outcomes, such that "you should be absolutely honest about how much you would be willing to pay — do not under- or over-state the amount".

The next 10 pages presented, in random order, 10 consumer products (listed in Table 3) with photographs, and asked (for example), "What is the maximum that you would be willing to pay for this 3 lb jar of jelly beans?" Participants typed a numeric value in dollars and cents before progressing to the next product. After responding to all 10 products, the task was repeated but participants had to indicate the maximum that "the next person to take this survey would be willing to pay" for each item. Finally, participants reported demographic information.

Study 2b was identical except that participants answered the question about subjective relative discretionary income after the WTP judgments.

3.2 Results and discussion

These and subsequent studies involved free estimates of own/others' WTP. Such data are typically positively skewed and include a handful of extreme values (e.g., Walasek, Matthews & Rakow, in press). We screened for outliers using the boxplot-based procedure for skewed distributions proposed by Hubert and Vandervieren (2004) and implemented by the adjbox function for the R statistical language (Rousseeuw et al., 2015), and removed responses that were more than three times the interquartile range away from the edges of the box. This led to removal of 48 observations

Table 3: Geometric means for Self- and Other-WTP values in Studies 2a and 2b.

	Study 2a			Study 2b		
	Self	Other	t (df)	Self	Other	t (df)
A 3 lb jar of jelly beans	6.61	9.83	11.95 (405)	7.67	10.28	9.89 (375)
A 7" Kindle Fire	93.97	122.60	9.47 (405)	104.67	121.99	8.06 (358)
A 14" gemstone globe	42.81	71.50	8.82 (404)	45.50	61.21	6.14 (375)
A Bissell bagless vacuum cleaner	83.78	114.20	10.71 (405)	84.01	113.77	8.97 (368)
A box of 40 deluxe Belgian chocolate	15.87	22.07	10.78 (403)	15.69	20.28	9.50 (377)
A leather-bound notebook	14.04	21.87	10.43 (397)	12.69	16.81	9.02 (369)
A National Geographic Atlas of the World	14.42	20.90	9.58 (404)	12.63	16.34	7.48 (366)
A Samsung Galaxy Gear Smartwatch	77.42	126.85	12.39 (403)	78.88	118.70	11.14 (378)
A one-year subscription to Scientific American	12.20	17.79	9.68 (403)	10.83	15.86	8.30 (372)
A TomTom SatNav with Lifetime Maps	59.98	101.54	12.18 (397)	67.33	97.89	8.33 (371)

Note: t's are for paired-samples tests comparing log-transformed Self and Other WTP values. All p's $< .001$.

(0.6%) in Study 2a and 109 observations (1.4%) in Study 2b. WTP estimates were log-transformed to help symmetrize the data. (Here and throughout, log-transformation was $\ln(x+1)$, to deal with possible zero values.)

We calculated the WTP gap (other-WTP minus self-WTP after log-transformation of each); more positive values indicate a stronger tendency to believe that others would pay more than oneself.

Figure 2 plots the WTP gap against subjective difference in discretionary income for each of the 10 products; larger values on the y-axis imply greater overestimation of others' WTP; larger values on the x-axis imply stronger belief that the other person is more affluent than oneself. The data from Study 2a are shown by circles; those from Study 2b are plotted as squares (the x-axis values have been offset slightly to separate the two data sets).

The plots illustrate the same effects as Study 1. First, the majority of participants believed that the next person's discretionary income is higher than their own (the data cluster in the right-hand side of each panel). In Study 2a the response to the discretionary income question ($M = 1.42$, $SD = 1.85$) was well above the value of 0 expected if people judged the next person's income to match their own, $t(407) = 15.51$, $p < .001$ The results from Study 2b were very similar, $M = 1.26$, $SD = 1.69$, $t(380) = 14.51$, $p < .001$.

Second, most participants believed that other people would pay more for each product than they would (the data cluster above $y = 0$). Table 3 confirms that, for all products, participants on average estimated the next person's WTP as substantially above their own.

Finally, the greater the subjective difference in affluence, the greater the WTP gap: participants who judged the next person to have much higher discretionary income than themselves also believed that the other person would pay considerably more for each product, illustrated by the simple regression lines (the dashed and dotted diagonal lines are for Studies 2a and 2b, respectively). The top section of Table 4 shows the results of fitting a mixed-effects model akin to that from Study 1, with fixed effects for subjective difference in discretionary income (SDDI) and the demographic variables household income, age, and gender; random effects for participant, product, and by-product random slopes for the effects of SDDI. (Here and in subsequent studies using linear mixed effects modelling, p-values are based on Satterthwaite's approximation and were computed using the lmerTest package for R; Kuznetsova, Brockhoff & Christensen, 2014.)

In both studies the WTP-gap is positively related to SDDI, confirming the impression from Figure 2. We calculated marginal R^2 values using the approach for the fixed effects component of mixed effects models described by Johnson (2014) and Nakagawa and Schielzeth (2013) using the MuMIn package for R (Barton, 2015; for simplicity the control variables were excluded). The values were .044 and .019 for Studies 2a and 2b, respectively. The effect is present irrespective of whether people indicated their relative affluence before or after making the WTP judgment; it seems to be slightly weaker in the latter case (Study 2b), but the change in participant populations between studies makes direct comparison impossible. Study 2b also shows an independent and rather counter-intuitive effect of household income on the WTP gap, with higher incomes predicting a greater belief that the next person would pay more than oneself.

Figure 2: The relationship between WTP gap and subjective affluence difference for each product in Studies 2a and 2b. x-axis values have been offset slightly to separate the two data sets (Study 2a = circles; Study 2b = squares). The lines show simple regression lines for Study 2a (dashed) and Study 2b (dotted).

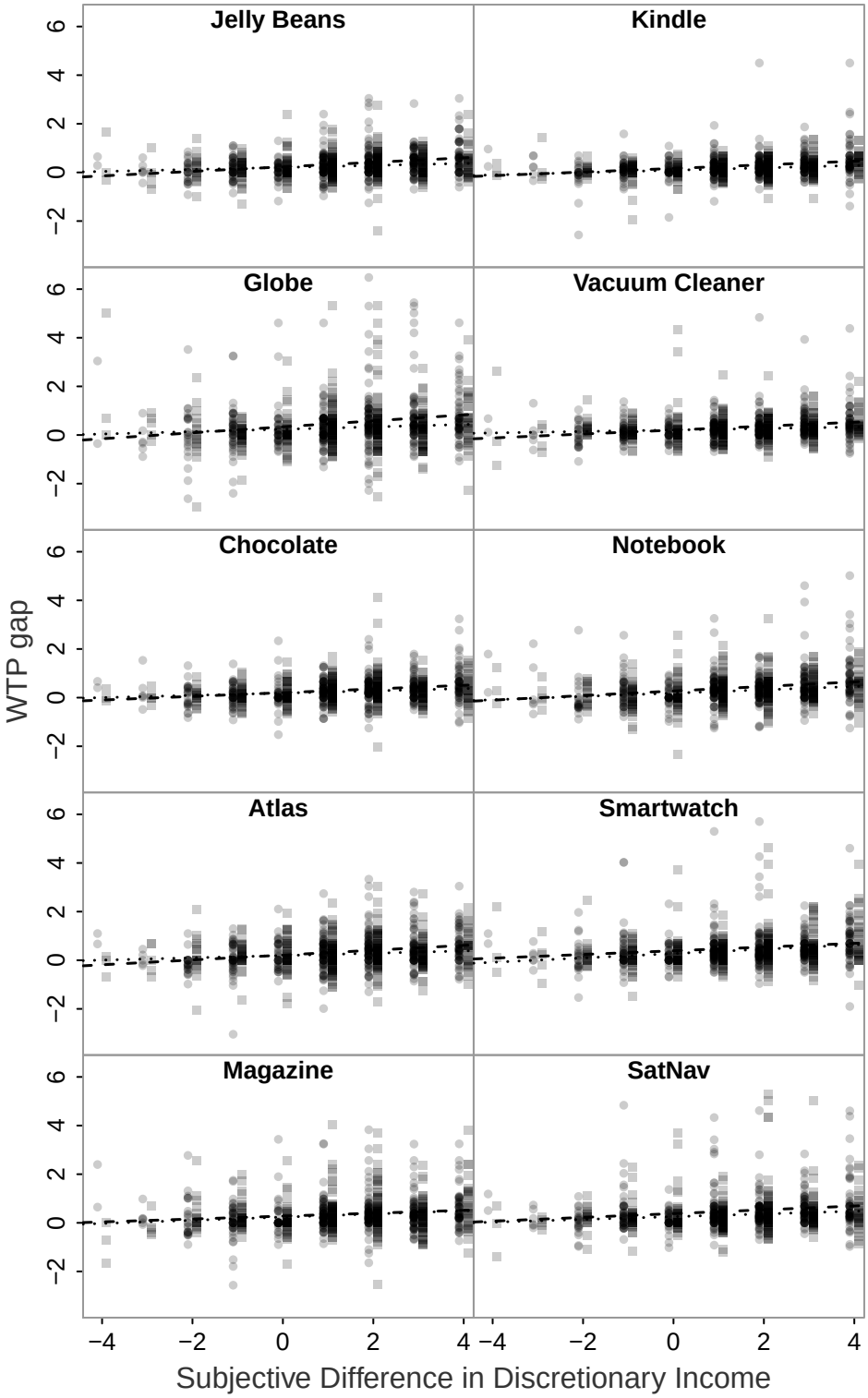


Table 4: Fixed effects for Studies 2a and 2b.

		Study 2a					Study 2b				
	Predictor	Coef.	CI_{lower}	CI_{upper}	t (df)	p	Coef.	CI_{lower}	CI_{upper}	t (df)	p
WTP-gap	Intercept	0.241	0.163	0.320	6.03 (43.7)	<.001	0.200	0.141	0.258	6.71 (52.1)	<.001
	SDDI	0.095	0.065	0.124	6.32 (220.7)	<.001	0.064	0.037	0.090	4.74 (99.1)	<.001
	z.INCOME	0.029	−0.024	0.081	1.06 (397.7)	0.291	0.053	0.011	0.095	2.48 (373.4)	0.014
	z.AGE	−0.033	−0.080	0.014	−1.36 (398.7)	0.174	0.006	−0.034	0.045	0.28 (374.2)	0.780
	z.GENDER	−0.008	−0.056	0.039	−0.35 (398.6)	0.729	0.017	−0.022	0.057	0.86 (373.6)	0.392
Self	Intercept	3.480	2.899	4.061	11.74 (9.3)	<.001	3.476	2.869	4.084	11.22 (9.2)	<.001
	SDDI	−0.045	−0.081	−0.010	2.52 (247.1)	0.013	−0.044	−0.083	−0.004	2.17 (122.5)	0.032
	z.INCOME	−0.017	−0.081	0.047	0.52 (401.6)	0.605	−0.029	−0.090	0.034	0.88 (374.2)	0.378
	z.AGE	0.002	−0.055	0.059	0.08 (402.2)	0.939	0.018	−0.040	0.077	0.61 (374.7)	0.542
	z.GENDER	0.0267	−0.031	0.084	0.91 (401.8)	0.362	0.027	−0.032	0.086	0.88 (374.2)	0.377
Other	Intercept	3.727	3.134	4.32	12.32 (9.1)	<.001	3.682	3.074	4.290	11.87 (9.1)	<.001
	SDDI	0.049	0.020	0.077	3.37 (90.3)	0.001	0.018	−0.011	0.048	1.21 (169.1)	0.227
	z.INCOME	0.009	−0.038	0.056	0.37 (396.2)	0.709	0.020	−0.029	0.069	0.79 (366.8)	0.429
	z.AGE	−0.029	−0.071	0.013	1.37 (396.4)	0.171	0.022	−0.025	0.068	0.92 (366.3)	0.358
	z.GENDER	0.018	−0.024	0.060	0.86 (396.8)	0.392	0.041	−0.005	0.088	1.73 (366.6)	0.084

Note: SDDI = Subjective Relative Discretionary Income. df and p-values based on Satterthwaite approximation.

Notably, the intercepts are significantly above zero, implying that even participants who judge their own discretionary income to be identical to the next person's believe that the next person would be willing to pay more.

We repeated these regression analyses but with Self-WTP and Other-WTP as separate outcome variables (see Table 4; marginal R^2 calculated as above were .003 and .005 for the Self and Other data of Study 2a, and .002 and .001 for Study 2b). In both studies, participants who believed themselves relatively better off had higher WTP for the products. In Study 2a, participants who regarded themselves as less affluent also gave higher estimates of the next person's WTP; the effect in Study 2b was in the same direction but not significant. No other predictors were significant — including household income. Thus, participants' willingness to pay was better predicted by their sense of their relative affluence than by a (rather crude) objective measure of spending power.

Using these regression models, we calculated the expected Self-WTP and Other-WTP (across all products) for participants who believed their own wealth to exactly equal the next person's: the values were \$32.46 (self) and \$41.55 (other) in Study 2a, and \$32.33 (self) and \$39.73 (other) in Study 2b, giving WTP gaps of \$9.09 and \$7.40, respectively. Computing the same expectations for participants at the mean value of the comparative-affluence question (recall that participants on average believed that they were worse off than their peers) yielded self-other gaps of \$14.10 (and increase of 55%) and \$10.05 (and increase of 36%) for Studies 2a and 2b, respectively.

We conducted two additional analyses. First, we repeated the analysis of the Self-WTP data but this time without including subjective relative discretionary income as a predictor, in order to further examine whether actual household income predicted people's product valuations. There was no indication of an effect for either study (for Study 2a, the coefficient was 0.022, 95% CI: –0.035, 0.079; for Study 2b it was –0.004, 95% CI: –0.063, 0.055; the results were virtually identical when we allowed the slopes to vary randomly across products). Thus, we found little indication that people's actual affluence (albeit rather crudely measured) predicted their willingness to pay for the products studied here.

Second, we plotted the other-WTP estimates against self-WTP values. For every product in both studies, participants with higher self-WTP reported higher other-WTP (all Pearson's r > .47, all $p < .001$), consistent with the possibility that people partly base their judgments of others' WTP on their own WTP. In addition, the regression lines were swivelled towards the horizontal (coefficients ranged from 0.310 to 0.651; $M = 0.498$) in keeping with the central tendency

of judgment seen in many domains, including price judgments (e.g., Matthews & Stewart, 2009). This might be a simple consequence of error in the predictor variable (the "error in variables" problem). An alternative (not mutually exclusive) possibility is that people partly base their other-WTP estimates on their own WTP, but that they take into account the extremity of their valuations and guess something closer to the mean of the distribution.

4 Study 3

Study 3 sought to establish a causal link between beliefs about others' affluence and beliefs about their willingness to pay.

4.1 Method

4.1.1 Participants

Participants were recruited via MTurk. IDs/ip addresses that had taken part in Studies 1 or 2a were excluded leaving a sample of 311 (117 female, ages 18–69, $M = 34.5$, $SD = 10.8$).

4.1.2 Design and procedure

Participants were asked to think about a person who is attending a special kind of auction for various consumer products, with instructions similar to Studies 2a and 2b. On the next page, participants were randomly assigned to a "low income" condition ($N = 155$) or a "high income" condition ($N = 156$), such that they were told that the person taking part in the auction has a personal income of $10,000 [$60,000] per year, "which puts them in about the bottom [top] 20% of people in the US".

The following 10 pages each showed a product image and description, and asked: "What would the person bid (i.e., what is the most that they would be prepared to pay) for this…". Table 5 lists the products. Participants entered their responses in a text box. Product order was randomized, but a software error meant that the "blender" came first for most participants. Finally, participants entered demographic information.

4.2 Results and discussion

Forty responses (1.3%) were excluded as outliers (their inclusion did not affect the pattern of significance). Table 5 shows the geometric means and results of independent-sample t-tests for every product. In all cases, estimated WTP was higher in the high-income condition than in the low-income condition.

Explicitly stating the other person's income in this way might entail demand characteristics, a concern which could partly — but probably never fully — be ameliorated by rendering the other's affluence more subtly (for example, by presenting a character sketch and having people estimate the individual's salary on a scale whose set of values imply a high or low income). Nonetheless, the data provide reasonable evidence that beliefs about another person's affluence causally affect beliefs about their willingness to pay for consumer products.

5 Study 4

We next investigated whether the relationship between affluence beliefs and WTP estimates applied in a between-group design, where one set of participants estimated the valuations of another group. We also sought to generalize the preceding results by having participants estimate other people's pre-tax incomes on a dollar scale, and with people making judgments about a real financial transaction under accuracy incentives.

Study 4 served as pilot for Studies 5a and 5b. Participants were told about a study of consumer behaviour in which 20 adults had been recruited to take part in a Vickrey second-price auction. The participants estimated both the average annual income of this (hypothetical) sample of 20 people, and the average of the 20 bids that would be submitted in the auction.

5.1 Methods

5.1.1 Participants

The final sample comprised 389 (145 female, ages 18–70, $M = 34.2$, $SD = 11.8$) recruited via MTurk. The lapse of time and change of task meant that we did not screen for participation in earlier studies.

5.1.2 Design and procedure

Participants were asked to suppose that the experimenter is going to recruit a sample of 20 participants for a study looking at spending behaviour, and that these participants will "be a mixture of staff and students at the University where I work. The people will be a mix of men and women, and none of them will be under 18 or over 60 years of age. All of them will have a regular income."

Participants then completed two tasks. In one, they estimated the average of the annual pre-tax income of the 20 people in the sample, to the nearest thousand dollars per year, by moving a slider whose range spanned 0 to 200 (with responses multiplied by 1000 for analysis). In the other task, they were informed that the 20 people would take part in an

Table 5: Geometric means for the Low- and High-income conditions of Study 3.

Product	Low	High	t (df)
10 oz French Vanilla Scented Candle	4.70	9.97	11.05 (307)
30" x 60" Beach Towel	5.84	10.20	8.62 (286)
DecoMates Wall Clock	9.65	20.48	10.16 (309)
Fiskars Big Grip Trowel	5.39	10.91	10.17 (279)
George Foreman Family-Size Grill	29.05	48.78	7.81 (306)
Hamilton Beach Multi-function Blender	26.12	56.24	11.56 (308)
Heavenly Honeycomb 12" Chocolate Pizza	8.70	14.87	9.26 (298)
Hooded Sweatshirt	13.74	21.53	7.96 (286)
Nokia Lumia 920 32Gb 4G Phone	105.66	191.94	7.46 (309)
Canon 16.1 Megapixel Digital SLR Camera	127.20	281.66	8.84 (286)

Note: All $p < .001$. df were Welch-corrected where necessary and are rounded to nearest integer.

auction for a "Hotel Chocolat" Dinner Party Hamper. This product was pictured and fully described, and on the next page participants read the instructions for the auction: each person would submit a private bid; the highest bidder would win, and would pay the value of the second-highest bid. It was explained that the optimal strategy is to bid exactly the maximum that one is willing to pay for the item. Participants then estimated the average amount that would be bid for the hamper. The order of the income-estimation and bid-estimation tasks was randomized.

Participants next used a slider to indicate the number of people that were to be recruited for the auction as an attention/memory check. Finally, they entered demographic information.

5.2 Results and discussion

Twenty three participants (5.9%) failed the attention check and were excluded. Six participants (1.6%) were excluded because of outlying WTP and/or income estimates. Log-transformed WTP estimates served as the dependent variable in a linear regression with estimated income (ESTINC) as the key predictor. The regression model also included task order (ORDER, coded 0 when WTP estimate preceded income estimate and 1 when the order was the opposite) and its interaction with income estimate; gender; age; and own household income. All predictors were standardized (the interaction term was computed from the standardized variables and was not itself standardized) and all variables were entered simultaneously.

The results are shown in Table 6. The key finding is that WTP estimates were positively related to income estimates ($\Delta R^2 = .050$; Curtin, 2015); in addition, WTP estimates increased with participant age. Repeating the analysis with outlying responses included had little effect on the coefficients except that age was no longer significant. Repeating the analysis including the participants who failed the attention check had very little effect on the coefficients, except for a weak tendency for women to produce larger estimates than men ($b = 0.082$, $p = .032$).

6 Studies 5a and 5b

Studies 5a and 5b replicated Experiment 4 but using a real financial transaction and accuracy incentives.

6.1 Auction

First, 25 employees of the University of Essex (14 female, ages 22–54, $M = 36.0$, $SD = 10.0$) were paid £5 to take part in an auction. They completed a computer-based task in individual cubicles. They learned that they were taking part in an auction for a "Chocolate Lovers Gift Hamper", and were shown a picture and full description of this product (retail price excluding delivery £38.25). The instructions for the Vickrey auction were similar to those of Study 4, and explained that participants should indicate the most that they would be prepared to pay for the product. It was emphasized that the auction was real that participants could submit bids that were as little or as much as they liked (including zero).

After submitting their bid they provided demographic information, including their annual pre-tax income (reported as an exact numerical amount; anonymity of data storage was assured). Participants were asked not to discuss their bid with anyone else.

Table 6: Regression analyses for Studies 4–5b.

	Predictor	Coef.	CI_{lower}	CI_{upper}	t	p
4	Intercept	3.889	3.814	3.964	102	<.001
	z.ESTINC	0.174	0.097	0.252	4.41	<.001
	z.ORDER	0.022	−0.053	0.098	0.58	0.564
	z.ORDER* z.ESTINC	0.005	−0.071	0.080	0.12	0.902
	z.AGE	0.114	0.038	0.190	2.96	0.003
	z.GENDER	0.067	−0.009	0.143	1.75	0.082
	z.INCOME	−0.038	−0.116	0.039	0.98	0.33
5a	Intercept	3.009	2.95	3.068	101	<.001
	z.ESTINC	0.062	0.001	0.122	1.99	0.047
	z.SAMPLE	0.035	−0.027	0.097	1.12	0.265
	z.ORDER* z.ESTINC	−0.029	−0.085	0.027	1.02	0.308
	z.AGE	0.041	−0.019	0.101	1.33	0.183
	z.GENDER	−0.042	−0.102	0.017	1.40	0.164
	z.INCOME	−0.019	−0.079	0.041	0.62	0.538
5b	Intercept	2.934	2.879	2.989	106	<.001
	z.ESTINC	0.085	0.027	0.142	2.88	0.004
	z.INCENT	0.047	−0.007	0.102	1.70	0.089
	z.INCENT* z.ESTINC	−0.004	−0.059	0.050	0.16	0.872
	z.AGE	−0.049	−0.104	0.007	1.73	0.084
	z.GENDER	0.021	−0.034	0.076	0.74	0.458
	z.INCOME	−0.041	−0.099	0.017	1.38	0.169

Note: See text for definition of predictors. t-values greater than 100 rounded to nearest integer.

6.2 Results

The winning bid was £28.50, and the winner paid the second-highest value of £21.00. The mean, median and SD of the bids and self-reported incomes are shown in Table 7. Both variables were positively skewed, particularly the bid values. Income and WTP were uncorrelated, $r = 0.13$ [95% CI: -0.279, 0.500], $t(23) = 0.63$, $p = .534$ [Spearman's $\rho = .171$, $p = .413$].

6.3 Main experiments

Study 5a was very similar to Study 4, except that (a) the participants were (like the participants in the auction) based in the United Kingdom, (b) they were asked to estimate the incomes and WTP for the real auction rather than a hypothetical one, (c) they were given an incentive for accuracy, and (d) they estimated incomes by entering a free-text response rather than adjusting a slider.

The data from Study 5a were somewhat noisy; Study 5b was a replication which used a U.S. sample and which manipulated accuracy incentive.

6.4 Methods

6.4.1 Participants

In Study 5a, a total sample of 556 participants (363 female, ages 16–64, $M = 26.8$, $SD = 9.3$) was obtained from two sources in parallel: 385 were recruited from the "Prolific Academic" on-line recruitment tool, pre-selected to be resident in the U.K.; the remaining 171 were staff and students at the University of Essex, recruited via an email to the University participant panel. For Study 5b participants were recruited via MTurk (those whose ids/ips had been used for Study 4 were excluded); the sample comprised 837 participants (328 female, ages 18–77, $M = 32.9$, $SD = 10.7$).

6.4.2 Design and procedure

In Study 5a participants were told that we had recruited a sample of 25 employees from a British University to take part in an auction for the chocolate hamper. The instructions and task were similar to Study 4, except that (a) the auction was no longer presented as hypothetical/in the future, and (b) participants were told that there would be a £10 bonus for the most accurate response to each of the two questions that they would be asked.

Participants first estimated "the average (arithmetic mean)" annual pre-tax income of the 25 auction participants (entering their response as a free numeric value). They were then given a copy of the instructions that the auction-participants had seen and estimated the average of the 25 bids. They subsequently completed the attention/memory check from Study 4 – which we label the "sample size check" — as well as an additional 4-alternative multiple choice question about the rule for deciding who would win the auction and how much they would pay – which we label the "auction rules check". Finally, they provided demographic information; the response categories for the question about about own annual household income were converted into pounds Sterling.)

Study 5b was identical except that: (a) the sample of 25 auction-participants were described as being recruited from "a University" (rather than a British University), (b) approximately half ($N = 406$) were given the accuracy incentive: they were told that there would be a $15 dollar reward for the most accurate response to each of the two estimates; the remaining participants received identical instructions but without this information. Participants' responses were converted into Sterling using the exchange rate from the day of the study, and the debriefing explained that the original

Table 7: Actual and estimated bids and incomes for the auction used in Studies 5a and 5b.

	Incomes			Bids		
	M	SD	Mdn	M	SD	Mdn
Auction	£24,398	£12,586	£21,500	£9.56	£7.95	£7.00
Study 5a	£26,248	£9,298	£25,000	£23.43	£15.91	£20.00
Study 5b	£28,077	£9,397	£27,246	£23.30	£18.84	£19.56

Note: "Auction" refers to the real responses of the sample recruited to take part in the auction. Responses from Study 5b have been converted to pounds Sterling.

auction was run in the U.K., and that the participants' responses would be converted into Sterling when determining their accuracy.

6.5 Results and discussion

6.5.1 Study 5a

Seventy five participants (13.5%) incorrectly answered the sample-size check question and were excluded. A further 26 (5.4%) were excluded because of outlying WTP and/or income estimates, leaving a final sample of 455.

Descriptive statistics are shown in Table 7, which shows that mean estimated average WTP (i.e., the average bid) was more than twice the true value. To compare the estimated average WTP with the average produced by the participants in the auction, one may either treat the latter as a single, fixed value using a one-sample t-test or acknowledge that, even though our auction produced a single "true" mean, this will be subject to sampling error so that it is more appropriate to use a Welch t-test to compare the mean of the average WTP estimates with the mean of the true WTP values. We took the latter approach (using $\ln(x+1)$ for both data sets) and found a significant difference between estimated and actual average WTP, $t(25) = 4.97$, $p < .001$.

The mean estimated average income was approximately 7.5% greater than the true value, a difference that was not significant, $t(25.46) = 0.72$, $p = .476$. (As noted above, the true auction-goers' data were positively skewed; there was much less skew in the estimates, so neither set was transformed for this analysis.) The median values show the same modest overestimation of income as the means.

The WTP estimates were submitted to a regression analysis with participants' estimates of the auction-goers' incomes (ESTINC) as the key predictor of interest. Participant sample (SAMPLE: Prolific Academic vs. University of Essex, coded 0 and 1 respectively) and its interaction with income estimate as well as the demographic variables gender, age, and participants' own household income were included as predictors (with standardization as for Study 4). The results are shown in Table 6.

Participants' estimates of mean auction bids were positively related to their estimates of mean income. However, although the effect is significant, it is weak ($\Delta R^2 = .009$) – and noticeably weaker than in Study 4. Repeating the analysis with extreme values included rendered the effect of income-estimates non-significant ($b = 0.053$, $p = .479$) and led to age being a weak but significant positive predictor ($b = 0.088$, $p = .022$). Noticeably, the outlying responses include values which exert great influence and are almost certainly typos – e.g., estimated average bids of £2500 and estimated average income of £1 per year.

We also re-ran the analysis without excluding participants who failed the sample-size check (but with outlier screening); the pattern mirrored the main analysis, with a slightly larger effect of estimated mean-income ($b = 0.075$, $p = 0.011$). Finally, we re-ran the analysis using only those participants who passed both the sample-size check and the auction-rule check (again, with outlier screening; final sample size = 371). The results were similar to the main analysis, except that the effect of income estimates, while still positive, was no longer significant ($b = 0.050$, $p = .147$).

Taken together, the data suggest a weak positive relationship between people's estimates of the auction-goers' mean income and the estimates of the mean bid in the auction. However, the finding is not convincing, particularly when compared with Study 4.

6.5.2 Study 5b

A total of 84 participants (10.0%) incorrectly answered the sample-size check question and were excluded (43 from the incentive condition, 41 from the no-incentive condition). A further 21 (2.8%) produced outlying income and/or WTP estimates and were also excluded, leaving a final sample of 732 (382 in the no-incentive condition, 350 in the incentive condition).

As shown in Table 7, the mean estimated average WTP (after converting WTP and income estimates to Sterling) was again more than twice the value of the true mean,

$t(24.87) = 4.60$, $p < .001$. The mean estimated average income was approximately 15% greater than the true value, although the difference was not significant, $t(24.92) = 1.45$, $p = .160$. The American participants in this study probably based their WTP and income estimates on U.S. norms, which are likely to differ from those in the U.K., where the auction was conducted.

As in Study 5a, we regressed log-transformed estimates of average WTP onto estimated annual incomes; we included incentive condition (INCENT, coded 0 for no incentive and 1 for incentive) and its interaction with income estimate, as well as age, gender, and own household income, as predictors (Table 6). Estimated average bids were positively related to estimated average incomes ($\Delta R^2 = .112$). Repeating the analysis with outliers included led to very similar results, except that WTP estimates were now significantly larger when participants were given an incentive for accuracy ($b = 0.062$, $p = .037$). Re-running the original analysis without excluding participants who failed the sample-size check had no effect on the pattern of significance and slightly increased the size of the effect of income estimate ($b = 0.101$, $p < .001$). Finally, we re-ran the analysis using only those participants who passed both the sample-size check and the auction-rule check; the results mirrored the main analysis except that the negative relationship between participant age and WTP estimates was now significant ($b = -0.065$, $p = .027$).

In short, this study confirmed the rather weak effect found in Study 5a and establishes that affluence-beliefs predict estimates of others' WTP in a between-group design: estimated average WTP was positively related to estimated average income. There was no indication that accuracy incentives modulated this effect or altered engagement with the task.

7 Experiment 6

This experiment sought a clearer understanding of how people judge their own wealth relative to others. In a very simple task, participants reported their own annual income and estimated that of the next person to take part in the study.

7.1 Method

7.1.1 Participants

A sample of 433 participants (273 male, ages 18-72, $M = 31.8$, $SD = 9.9$) were recruited via MTurk. (This study was conducted after Study 3 but before Studies 4-5; because the task is quite different from the WTP judgments of earlier studies, participants were not screened for participation in these studies.)

7.1.2 Design and Procedure

On one page participants were asked to "think about the next person who will complete this survey. What is your best estimate of their annual pre-tax income? (That is, how much do they make each year, before taxes?") and typed their judgment in a text box. A separate page used identical wording but asked about "your own" pre-tax income. The order of the tasks was randomized (217 participants reported "self income" first; 216 estimated "other income" first). Participants then reported their gender and age.

7.2 Results and discussion

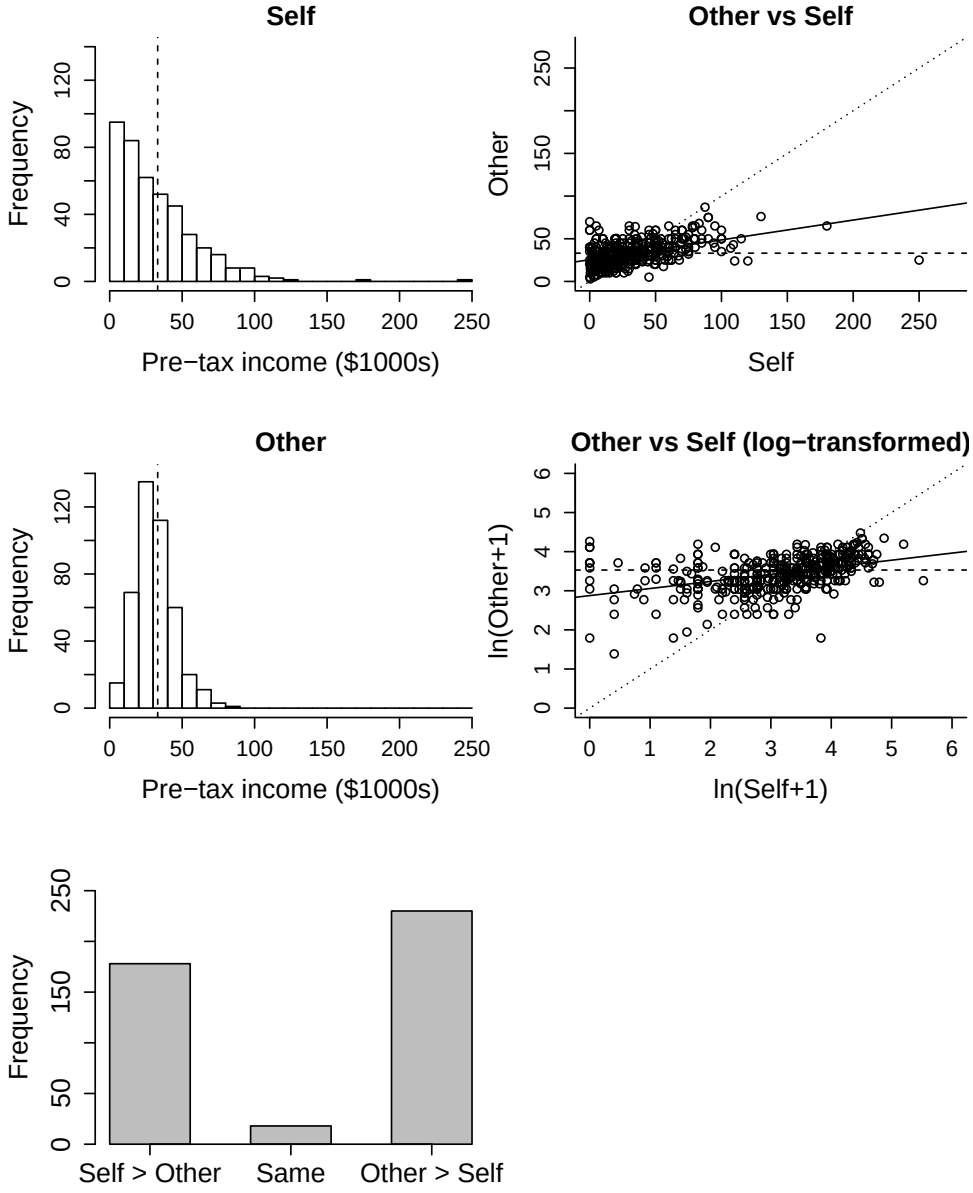
Seven participants (1.6%) were excluded for producing outlying responses (1 for "self-income"; 6 for "other-income").

The top left panel of Figure 3 shows the distribution of participants' incomes; the vertical dashed line shows the arithmetic mean of \$33,101 ($SD = 28,483$). The next panel down shows the distribution of estimated incomes; this is less positively skewed, with an arithmetic mean of \$33,121 ($SD = 13,709$). A paired t-test found that participants' estimates of the next person's income did not, on average, differ from their self-reported income, $t(425) = 0.02$, $p = .987$. In other words, the average estimate of the next person's income almost exactly matches the true expected value of that income.

However, because the true income distribution is positively skewed, the majority of participants (58.2%) have incomes which are below the mean. The bottom left panel of Figure 3 shows the number of participants who judged their own income to be greater than, the same as, or less than that of the next person; the proportion who indicated that the next person would have a higher income than them (54.0%) was greater than the proportion who judged that the next person would have a lower income than them (41.8%), $\chi^2(1) = 6.63$, $p = .010$.

The right-hand panels plot the relationship between self- and other-income estimates (the lower panel shows the results after log-transformation, which clarifies the pattern). The dashed horizontal line shows the true mean income of the sample – i.e., the pattern expected if estimates were perfectly accurate. The dotted diagonal line shows the pattern expected if participants simply stated their own income when estimating the next person's. The solid black line shows the regression line and illustrates that participants' estimates of the next person's income were positively correlated with their own (for raw data: $b = 0.232$, $t = 11.35$, $p < .001$, adjusted-$R^2 = .23$; for log-transformed data: $b = 0.181$, $t = 9.66$, $p < .001$, adjusted-$R^2 = .178$). Thus, these income estimates mirror the finding in Studies 2a and 2b for self- and other-WTP estimates: participants seem to base their estimates of the next person's income on their own income, with poorer participants typically adjust-

Figure 3: Results for Study 6. Left hand panels: distribution of self-reported annual pre-tax incomes (Self) and estimates of the next person's income (Other); vertical dashed lines show the distribution means, which are very similar; the bottom panel shows the number of participants judging the next person as having lower, higher, or the same income as them. Right-hand panels show the relationship between judgments of the next person's income and the participant's own income. The solid lines are OLS regression lines; the dashed lines show performance if participants perfectly reported the expected value of the next person's income (i.e., the mean of the self-reported income values); the dotted line shows performance if participants indicated that others' income exactly matched their own.



ing upwards and richer participants adjusting downwards from this self-reference point, albeit insufficiently (e.g., Epley & Gilovich, 2004) — although, as for the WTP data, we cannot exclude the possibility that this effect is partly a consequence of measurement error in the predictor variable.

To summarize: on average, people accurately estimated the expected income of the next participant, and for the majority of participants this involved estimating an income that was greater than their own.

8 General discussion

We set out to address three questions: (1) Is the overestimation of other people's willingness to pay for consumer products a robust and generalizable effect? (2) Do people's beliefs about others' affluence influence their beliefs about others' willingness to pay? And (3) Do these affluence-beliefs contribute to the overall overestimation effect? We discuss these points in turn and conclude by offering directions for future research.

8.1 Is the overestimation robust?

Our participants systematically over-estimated how much others would pay for a wide range of consumer products: Most people judged that the "typical participant" would pay more than they would for most things (Study 1), and mean estimates of the amount that the next participant would pay were substantially higher than the mean self-reported WTP, with the vast majority of participants judging that the next person would pay more than they would (Studies 2a and 2b). Similarly, when participants judged the mean auction bid of a separate group of people taking part in a real auction, the mean estimate was approximately twice the true value, irrespective of whether participants were given incentives for accuracy (Studies 5a and 5b). Thus, the overestimation and self-other gaps reported by Frederick (2012) seem robust and widespread.

8.2 Do affluence-beliefs predict WTP-beliefs?

Beliefs about others' affluence consistently predicted beliefs about how much they would be prepared to pay. First, when participants judged the proportion of others with more money than themselves, their estimates were positively related to the probability of judging that the typical participant would pay more than they would (Study 1). Second, when participants gave explicit WTP values and estimated those of the next person in the study, beliefs about relative willingness to pay were positively related to beliefs about relative discretionary income. Third, when participants estimated the mean bid of people taking part in an auction, their judgments were positively related to their estimate of the mean salary of the auction-goers (Studies 4, 5a, and 5b). And finally, WTP estimates were higher when participants were told that the target individual was affluent than when he/she was described as poor, confirming a causal link between affluence-beliefs and WTP-beliefs (Study 3). These effects were not strong, but they were consistent across tasks and samples.

Our results suggest that part of the variation in beliefs about other people's willingness to pay is due to variation in beliefs about their affluence: if John believes that Jane is rich but Julian believes that she is only moderately well-off, John's estimate of Jane's WTP is likely to be higher than Julian's estimate. We did not ask people to estimate the WTP values of multiple others, so we cannot be sure that this affluence-WTP association holds within participants. However, the effects of randomly assigning people to judge the WTP of a poor/rich individual Study 3 suggests that it does.

Why is perceived affluence positively related to perceived WTP? The relation could reflect a general response bias: some people might simply produce larger values in any estimation task. However, there was no effect of reverse-wording the affluence-belief question (Study 1) or of accuracy incentives (Study 5b) so a bias explanation is unlikely. Similarly, although we found some evidence that people anchor on their own circumstances when estimating others' WTP and income, the fact that affluence and WTP estimates were on completely different scales makes it unlikely that one served as an anchor for the other (Frederick & Mochon, 2012). And magnitude or numeric priming effects, which might generalize across scales, are extremely weak (Brewer & Chapman, 2002; Matthews, 2011), unlike the robust affluence-WTP association that we found.

We therefore suggest that people explicitly or implicitly believe that spending power predicts willingness to pay. As we noted in the Introduction, there are certainly situations where this will be true: in the limit, WTP for a medium-value item must be lower for the poorest individuals (assuming little access to credit), and for the most valuable products the richest people will be able to state higher WTP than the rest of the population. Quite possibly participants have generalized these principles into a broader belief that affluence and WTP are positively linked across a full spectrum of wealth states and product types – possibly even believing that WTP will be a fixed proportion of the money a person has to spend on goods and services. The same generalization could arise in other ways. For example, people might (illogically) infer that, because the rich often have more expensive possessions than the poor, they must be prepared to pay more for any given item. Equally, the affluence-WTP association may arise from the generalization that humans typically show diminishing sensitivity to virtually every quantity, with people believing that a given expenditure will "feel smaller" if it comprises a smaller proportion of one's available money and thus that richer people will have higher WTP because "they will hardly notice the cost".

Our studies were not intended to comprehensively test the true relation between WTP and wealth or income, in part because establishing good estimates of these variables is very difficult: indeed, the key variable would be "ability to pay", a complex construct that depends on income, liabilities, family size, cash reserves, and so on. Nonetheless, our data do suggest that the belief in an affluence-WTP association is unwarranted for the people and products that our participants were being asked to judge. Studies 2a and 2b found little evidence for a positive relation between self-

WTP and the household income control variable, and there was similarly only a very weak association between true incomes and bids in the chocolate-hamper auction at the start of Study 5a. Indeed, a little reflection suggests that affluence and willingness to pay will not always be positively linked. For example, wealthy individuals already own many items that poorer individuals do not, and will therefore have less need for them.

Other research is similarly ambivalent regarding the link between ability and willingness to pay. For example, Misra, Huang and Ott (1991) report a positive relationship between income and WTP for pesticide reduction, and Reynisdottir, Song and Agrusa (2008) found that higher household income predicted greater WTP for entry into a national park; in contrast, Gaugnano and colleagues (1994; Guagnano, 2001) found no relationship between income and WTP more for consumer goods that reduce environmental damage, Jorgenson and Syme (2000) found no effect of household income on WTP for measures that reduce stormwater pollution, and Cohen, Rust, Steen, and Tidd (2004) found that richer individuals were prepared to pay more for a reduction in most crimes, but not rape. (These papers provide useful literature reviews of other work showing similarly mixed results regarding the link between income and contingent valuations.)

In summary, we propose that many people implicitly equate how much others would be willing to pay with how much they can afford to pay. Irrespective of whether our interpretation is correct, and of the reasons why people make this (often inappropriate) generalization, the data show that latent beliefs about affluence contribute to individual differences in the overestimation effect.

8.3 Do beliefs about affluence explain the overall tendency to overestimate others' willingness to pay?

The effect of affluence beliefs on net WTP estimates depends on two functions: the subjective affluence-WTP function (which describes how WTP estimates change with beliefs about affluence), and the objective function (which describes how valuation of the product actually varies with changes in spending power among the target individuals). Assuming that the subjective function is monotonically positive (as our data suggest) then overestimation of other people's spending-power will lead to larger estimates of their WTP than would be produced if affluence judgments were veridical – thereby contributing to a net overestimation of others' WTP. (In principle, the effect might be to reduce an underestimation that might otherwise take place, but such underestimation has never been observed). Indeed, if the subjective and objective functions were perfectly superimposed then affluence-overestimation would be the *sole* cause of the WTP-overestimation effect, although this seems highly unlikely given the large size of the effect relative to the subjective affluence-WTP relationships that we have found, and the evidence from Frederick (2012) that WTP-overestimation has multiple causes.

The key question is therefore whether people tend to overestimation others' affluence. The evidence is mixed. In Study 1, participants on average judged that 61% of the other people in the study had more money than they did, and in Studies 2a and 2b the mean placements on a categorical scale indicated that subjective relative discretionary income was well below the mid-point (corresponding to the perception that one's own income was identical to that of the next person). Similarly, Cruces, Perez-Truglia and Tetaz, M. (2013) found that 55% of participants underestimated the decile of their own household income whereas only 30% overestimated it (and by a smaller amount than the underestimators). Set against these results, our Studies 5a and 5b found no overestimation of the mean income of the auction-goers, and Study 6 found that participants' mean estimate of the next person's pre-tax income closely accorded with the true mean: people, on average, had accurate beliefs about the expected income of the next person.

There are many possible reasons for these mixed results: gross income may be estimated differently from discretionary income or from "having money", and estimating proportions and using a categorical scale may be fundamentally different from producing precise numeric income values. In other studies, researchers have found that subjective wealth distributions depend on how they are measured (e.g., Eriksson & Simpson, 2012; Norton & Ariely, 2011), and our work provides further evidence that beliefs about others' affluence depend on the elicitation procedure. Notably, our Studies 1 and 2 emphasized comparative judgment (how many people are richer/poorer than you, how does your discretionary income compare with the next person's?). Possibly people have a tendency to "feel" worse off than others – for example, because of the salience of extremely wealthy individuals or a tendency to focus on upward social comparisons (Buunk et al., 2003), or because the skewed distribution of incomes means that the majority of people are, indeed, below the expected value (Study 6).

Taken together, the evidence indicates that there are at least some circumstances in which members of a group will, on average, judge themselves as being poorer than the other members. This, coupled with the belief that higher affluence equates to higher product valuations, will contribute to the net overestimation of others' willingness to pay. However, affluence judgments cannot explain the entirety of the WTP-overestimation because even those participants who judge their own affluence to be above the median believe that the next person would pay more for the products, and in any case the proportion of the variance in WTP overestimation explained by beliefs about others' affluence is small. More importantly, affluence judgments are not always over-

estimates; establishing how people form latent beliefs about the spending power of others, and the circumstances that bias these estimates, is a key direction for future research.

9 Conclusions and future directions

The present studies found that people commonly overestimate how much others will be prepared to pay for products, that beliefs about others' willingness to pay are positively related to beliefs about their affluence, and that there is sometimes – but not always – a net belief that others are better off than oneself. Taken together, the results show that individual and group differences in the tendency to overestimate other-WTP are partly due to differing latent beliefs about the material circumstances of the target individuals, and that such affluence-beliefs, in some circumstances, contribute to the net overestimation of other people's willingness to pay. This seems especially likely when people directly compare their own affluence and their own WTP with those of other people.

Besides encouraging investigation of how people form beliefs about both the wealth and income of others, and the association between affluence and valuations, the current work suggests several interesting directions for future work, including:

The endowment effect. The tendency of owners to value products more highly than non-owners of the same product (the endowment effect) likely has multiple causes (e.g., Ericson & Fuster, 2014; Plott & Zeiler, 2005; Walasek et al., in press). Our results suggest that an additional factor may be the belief that a buyer is likely to have more money than oneself – and therefore be more able to pay to the product. Equally, a disparity in perceived relative affluence might engender a sense that it would fairer for the buyer to pay more.

Proxy decision making. There has been growing interest in how people make financial decisions on behalf of others. People tend to predict that others will be more risk-seeking than themselves (Hsee & Weber, 1997), and to be less loss-averse when deciding for others (Polman, 2012). The belief that others are more affluent than oneself may contribute to these tendencies, and may underlie individual and cross-study variations in the size of the tendency.

Public goods and charitable giving. Our work, like that by Frederick (2012) and the studies of "paying what you want" by Jung et al. (2014), has focused on products and services for personal consumption. It will be important to establish whether the overestimation arises when people are deciding how much to contribute to worthy causes or public goods such as environmental protection (Bekkers & Wiepking, 2011; Gneezy, Gneezy, Nelson & Brown, 2010). Previous work has shown that beliefs about how much others will contribute can be an important contributor to people's WTP for public goods (e.g., Eek, Biel & Gärling, 1998; Liebe, Preisendörfer & Meyerhoff, 2011); in particular, such beliefs affect the perceived *fairness* of particular contribution levels, and this concern with equitable distribution of costs is a key driver of WTP (see, e.g., Eek & Biel, 2003; Joireman, Kuhlman & Okada, 1994; Kyle, Graefe & Absher, 2002). The overestimation both of others' WTP and of their affluence found in the current studies could therefore have important implications for understanding contributions in public-goods dilemmas.

Relative affluence vs Relative deprivation. We have focused on people's beliefs about the (relative) affluence of themselves and others, similar to studies showing the importance of income rank and perceived socioeconomic status on well-being, employee satisfaction, and health outcomes (e.g., Boyce et al., 2010; Brown, Gardner, Oswald & Qian, 2008; Brown & Matthews, 2011; Kraus et al., 2013). Such studies emphasize objective or subjective rank, but ignore the experiences that may (or may not) accompany a position of relative disadvantage — and which may arise even in people who believe themselves to be wealthy or high-ranking. In recent work we have found that predictive power is boosted by measuring *personal relative deprivation* – the extent to which the individual feels resentment at their position relative to people whom they judge to be "like them" (Callan, Kim & Matthews, 2015a, 2015b). It seems likely that consumer decision-making will likewise be influenced by these feelings, over and above any latent beliefs about absolute or relative wealth, and it will be worth investigating whether they afford better predictions of beliefs about others' willingness to pay.

Overestimation of others' WTP is multiply-determined and remains mysterious. Beliefs about others' affluence are one contributor to the effect, and this relationship provides useful directions for future work.

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