LETTER

Reply to Frederick et al.: Anchoring effects on energy perceptions

Both our study (1) and the follow-up described by Frederick et al. (2) indicate that people know relatively little about how much energy is used by different devices and appliances. In our view, the additional data strengthen rather than weaken our original conclusions.

It is well known that numerical judgments are subject to anchoring effects, with initial values having substantial influence on final answers (3). In our article, we noted that the compressed range of respondents' energy estimates "almost certainly resulted from an anchoring bias in which the reference point provided in the task served as an anchor for participants' estimates, causing those estimates to be too similar to the reference point" (p 16057). This compression, combined with a relatively low reference point (a 100-W light bulb used for 1 h), contributed to the underestimation of energy use. We also predicted that "it would be possible to eliminate this underestimation (or even generate overestimation) by using a higher reference point" (*SI Text*, p 2). The follow-up study replicates our results for the light-bulb reference point and confirms the expected effects of other reference points on means and ranges, thereby verifying our account.

Before implementing our survey, we conducted several interviews in which participants thought out loud while estimating the energy use of different appliances, as commonly suggested in the survey-design literature (4). Without a reference point, interviewees found it hard to judge the energy use of different devices; however, using a light bulb as a reference (as opposed to other devices) made the quantitative judgments easier.

Frederick et al. (2) report that the most common response to the prompt "name something that uses energy to operate" was "computer" (30%). Although these participants were not necessarily selecting a reference point for energy estimates, the average 1-h energy use of a laptop and desktop computer [about (48 + 140)/2 = 94 Wh] is remarkably close to our light-bulb reference point (100 Wh). Any reference point in this range would lead to similar estimation results.

Because many people do not know what constitutes a watt or kilowatt, Frederick et al.'s two no-reference-point conditions were presumably difficult. The kilowatt condition seems particularly hard: because half the devices listed are rated as less than 1 kW, correct responses would have to be typed as decimals. Thus, we are not surprised that the 51-fold overestimation with kilowatts was larger than the sixfold underestimation with watts. More telling is that the average numerical responses in the two conditions differed by a factor of only (1,368/6)/(1.368 × 51) = 3.3 rather than 1,000. Therefore, what looks like a huge difference is actually *insensitivity* to the change of units.

In summary, we agree with Frederick et al. that estimates of energy use are labile. This instability follows from the lack of available information and people's lack of knowledge about energy use. However, when people choose their own (typically low) reference points, they underestimate the energy use of home appliances and underestimate the range of energy use among appliances. Correcting such misperceptions may be a necessary precursor to narrowing the US energy efficiency gap (5).

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