

Addendum to Pre-Analysis Plan for “Temperature and Economic Choices”

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This addendum to the Pre-Analysis Plan will cover three subjects: 1) the addition of sensors to capture potentially relevant non-temperature measurements, along with additional temperature and relative humidity (RH) sensors; 2) the investigation into the share of male participants in study rooms across sites, and its potential relevance for experimental outcomes; and 3) expanding the study sample to address these two issues.

1) Additional sensors

Following the pilot study, we discovered that the individual participant temperature/RH sensors were strongly affected by participants’ body heat due to their location underneath each desk and near to the participants’ legs. This meant that they recorded rapidly rising temperatures as soon as participants began the experiment and thus did not accurately capture the room air temperature. Because of this, we have added two additional sensors to each treatment group’s room. Both of these sensors are further from the participants, as described below. In addition, we later became aware of relevant work being performed by the Center for the Built Environment (CBE) at UC Berkeley, in which researchers are evaluating workplace productivity as a function of numerous environmental factors. In these conversations (occurring from the end of October to mid-November 2017), it became clear that we should additionally measure several of these factors demonstrated to be influential in such settings, to ensure that their values were relatively consistent across treatment and control groups. Importantly, this consistency will allow us to identify our target effect - that of higher temperatures. The state of knowledge of the effect of these environmental factors on productivity is still evolving at present, but central findings can be found in Wargocki et al. (2006).

The additional sensors are:

- 2 additional HOBO Temperature/Relative Humidity Data Loggers. These were again hidden from view of the participants. In each of the rooms, one was placed behind a partition, closer to the heating or cooling device, while the other was placed under a desk near the room’s research assistant. These two temperature measurements are averaged to obtain our estimate of the “room temperature” during each experiment.
- 2 HOBO MX1102 Carbon Dioxide Data Logger. One device is installed in each room to measure the average CO2 levels as well as the trends over the duration of the experiment. High CO2 levels have been shown in Allen et al. (2015) to be associated with lower cognitive function and can be affected by slightly different room orientations and ventilation rates. **Note:** In Busara, Tellaire 7001 CO2 monitors are being used due to their lower cost. CO2 measurements are being collected at 5-minute intervals.

- 1 Operative Temperature (T_o) sensor developed by the Center for the Built Environment. Operative temperature refers to the temperature experienced by a person and is roughly equivalent to the average of air temperature and the mean radiant temperature (MRT) of all surfaces exposed to the participant (see Huizenga et al. (2006)), and it consists of a Dallas DS18B20 Temperature Sensor inserted inside of a ping pong ball that is coated in matte grey paint. In rooms with thick walls and few windows (like those used for the experiment in Berkeley), MRT and air temperature do not typically diverge significantly; thus, we are likely capturing the experienced temperature of the participants through our air temperature sensors. However, forced air systems like the AC unit used in the control room can create differences in these two values. Even though we did not install the T_o sensors prior to initial enrollment, measuring T_o for a portion of the study will help us to calibrate our air temperature measurements to the operative temperature experienced by the participants. Operative temperature measurements are being collected at 5-minute intervals.
- 1 RISEPRO Digital Sound Level Meter 30. This sensor is used to measure background noise at each workstation, which has also been shown to have a negative effect on workplace productivity in Kim and Dear (2013). The measurement was obtained just once, when no participants were in the room, rather than on an ongoing basis during the experiments.
- 1 Dr.Meter LX1330B Digital Illuminance/Light Meter. This sensor measures illuminance at each workstation, which, along with lighting color, has been shown to affect productivity and mood in Hoffman et al. (2008). The measurement was obtained just once, when no participants were in the room, rather than on an ongoing basis during the experiments.

The above sensors were brought into the Xlab to record non-temperature measurements starting November 15, 2017, mid-way through the experiment. However, these sensors arrived at the Busara Center only in mid-January, after 800 participants had already been through the experiment. Because we wanted to collect these measures on real participants going through the actual experiment, we decided to increase the sample collected in each site (see Section 3 for more discussion on increasing the sample size).

2) Share of male participants in study rooms

In the course of trying to explain patterns observed across locations, we started (on January 23, 2018) to look more closely at imbalance in the share of male participants in each room across sites, as summary statistics had previously shown that there were more males in the Busara Center sample than in the Xlab sample. After looking at the distribution of the share of male participants in study rooms across sites and noticing an imbalance, we interacted the share of male participants in a study room with treatment as well as with both treatment and gender. After including the interaction terms in several specifications, we noticed significant effects, particularly for the Joy of Destruction module.

Figure 1 shows the distribution of the share of participants that were male in a study room, by site.¹ For interpretation, the left-most bar shows that almost 10 percent of rooms at the Xlab in Berkeley had zero females out of the total number of participants² in the room, while around 1 percent of rooms at the Busara Center in Kenya had zero females out of the participants in the room.

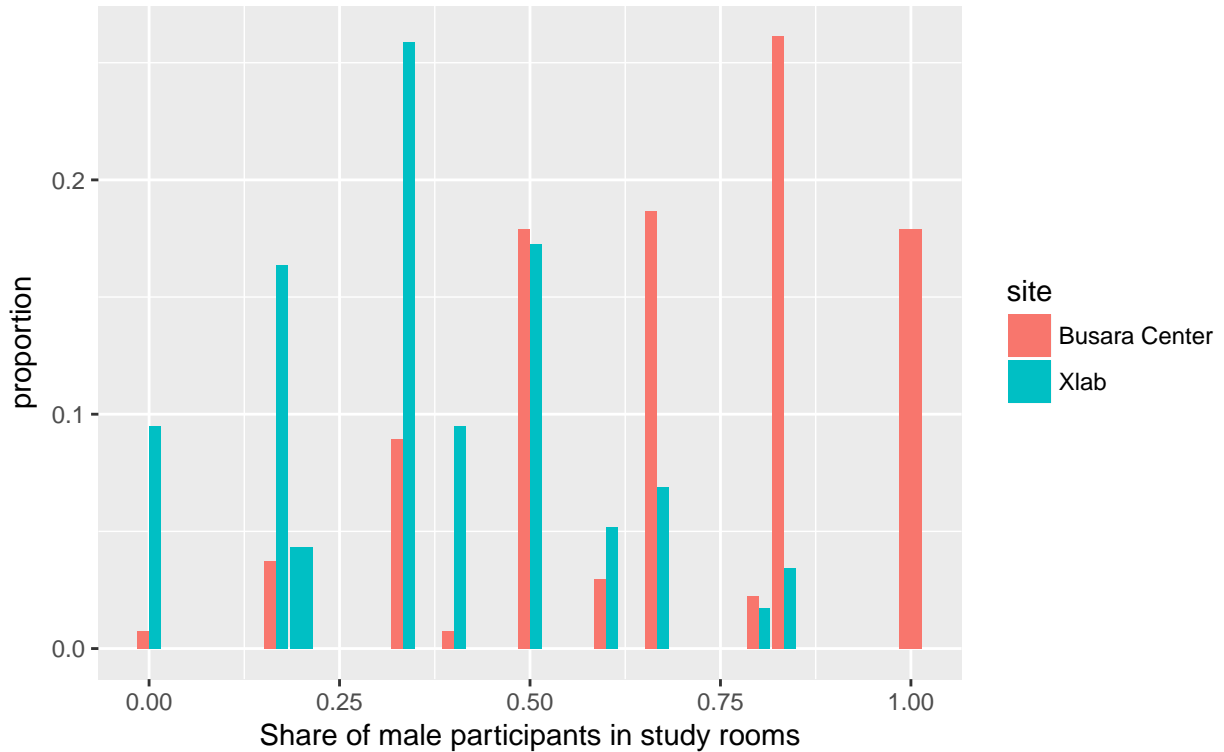
As noted, the distributions differ by site: while rooms in the Xlab at Berkeley tended to be female-dominated in terms of attendance, rooms in the Busara Center at the Busara Center tended to be male-dominated. Given this potentially relevant variable for experimental outcomes, we decided to recruit more of the gender demographic that was lacking in each site (see section 3 for more discussion).

¹The data featured here accounts for laboratory data up to December 14, 2017, which was the full extent of the data that we had on January 23, 2018.

²The total number of participants in a room was almost always six, but we allowed sessions to run for five participants. There were also several instances of non-response for the participant's gender, which affects the observed proportion of males in a study room.

Figure 1

The distribution of share of male participants in study rooms, by site



3) Expanding the study sample

As noted in Section 1, collection of the non-temperature measurements starting at the Xlab earlier than at the Busara Center. To obtain a sufficient number of non-temperature measurements in each location, we decided to increase the sample in each site to 900 participants, motivated by the desire to collect these extra measurements under actual study conditions. To address the lack of comparability in the distribution of share of male participants in study rooms across sites, we intended for that additional recruitment to make the distributions across sites more comparable (see below for discussion). However, recruitment at the Busara Center had already reached 900 participants before we could effect any change in targetting. Thus, while we will recruit up to 900 participants at the Xlab, we will recruit up to 1000 participants at the Busara Center. These changes to the sample size were not specified in the original Pre-Analysis Plan, nor were the measurements or inclusion of share of males in study room into the analysis.

To increase comparability with regards to the share of male participants in study rooms across sites, we aimed to start recruiting at a site-specific 1:5 gender ratio, starting the week of January 29, 2018. So, at the Xlab in Berkeley, we first aimed to recruit one female for every five males for all further sessions. Meanwhile, at the Busara Center in Nairobi, we first aimed to recruit five females for every one male for all further sessions. Given the difficulty of achieving this ratio on January 31, 2018 at the Xlab at Berkeley, we then moved to a 1:2 gender ratio at each site for sessions falling after January 31, 2018. Thus, at the Xlab we are recruiting one female for every two males for all sessions after January 31, 2018. Meanwhile, at the Busara Center we are recruiting two females for every one male for all sessions after January 31, 2018.

Citations

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