Supplemental Materials for Increasing Transparency through a Multiverse Analysis

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Increasing Transparency through a Multiverse Analysis

For the demonstration of the multiverse analysis in Steegen, Tuerlinckx, Gelman, and Vanpaemel (2016), we focused on Study 1 and Study 2 from Durante, Rae, and Griskevicius (2013). Kristina Durante kindly provided the raw data, which were collected with a survey, the processed data, and the research materials (i.e., the survey questions), and gave us the permission to make them publicly available. The data (and the code) can be found on `https://osf.io/zj68b/`. In the following, we will give a description of these files.

Our single data set analysis used the same processing choices as Durante et al. (2013). Note that Durante et al. (2013) write that women in both studies had regular monthly menstrual cycles (25–35 days), suggesting that they excluded women with cycle lengths shorter than 25 or longer than 35 days. However, looking at the data file, it seems that they did not exclude participants based on this criterion. When we do not exclude these women, our single data set analysis arrives at the exact same results as theirs.

Raw Data

Study 1

- WorkerID. ID of participant
- Answers to religiosity items. For items 2 and 3: "Please indicate how much you agree with the following statement".
  - Rel1: "How much do you believe in God?" 1– 9
  - Rel2: "I see myself as a religiously oriented person." 1 – 9
  - Rel3: "I believe that God or a Higher Power is responsible for my existence." 1 – 9
- Date Testing. Date of participant filling in the questionnaire.

- Answers to questions about menstrual period. "Please use the calendars to answer the following questions." (The calendars are not reproduced here.)
  - Start Date of Last Period: "Please give your best estimate of the date on which you started your last period (please be as precise as possible). This date was probably within the last few weeks. Sometimes thinking of where you were when you started your last period helps. For instance, was it on a weekend?, were you at work, was it during a football game?, etc. Please write the date in mm/dd/yyyy format (e.g., 8/18/2012)."
  - Sure 1: "How sure are you about that date?" 1 – 9. This variable was included in the data file, but it was not used in Durante et al.'s (2013) analyses.
  - Start Date of Period Before Last: "Please give your best estimate of the date on which you started the period before your last period (please be as precise as possible). Please write the date in mm/dd/yyyy format (e.g., 7/18/2012)."
  - Sure 2: "How sure are you about that date?" 1 – 9. This variable was included in the data file, but it was not used in Durante et al.'s (2013) analyses.
  - Cycle Length: "How many days long are your menstrual cycles? (for most women, the range is between 25-35 days) Keep in mind this is the number of days from the start of one menstrual period to the start of the next menstrual period and NOT the length of your menstrual bleeding." This variable was included in the data file, but it was not used in Durante et al.'s (2013) analyses.
- Relationship. "What is your current romantic relationship status?" (1) *not dating/romantically involved with anyone*, (2) *dating or involved with only one partner*, (3) *engaged or living with my partner*, (4) *married*, or (5) *other*. If participants picked response (5), they were prompted to provide a description of their relationship, which was subsequently coded into one of the four options by the original authors. In the data made available to us, all (5) responses were already coded into another response option. In this sense, the data we start from in our

multiverse analysis do not fully correspond to the raw data. Further, Durante et al. (2013) describe response option (2) as *dating*, but the materials indicate *dating or involved with only one partner* was used.

- The following additional raw variables were included in the survey, but were not used in the analysis reported by Durante et al. (2013) or by Steegen et al. (2016): Age ("How old are you?"); Ethnicity ("What is your ethnicity?"); Income ("What is your current household income?"); Children ("Do you have children?"); "What Country/State do you live in?". The responses to the last question were not included in the data file we received.

Study 2

The raw data included the same variables as in Study 1, plus the following variables.

- Answers to fiscal political attitudes items ("Please indicate how much you agree with the following statements.")
  - RichTax: "The rich should pay a higher tax rate than the middle class." 1 – 7
  - TooMuchProfit: "Business corporations make too much profit." 1 – 7
  - StandardLiving: "Government should ensure that all citizens meet a certain minimum standard of living." 1 – 7
  - FreeMarket: "In nearly every instance, the free market allocates resources most efficiently." 1 – 7
  - PrivSocialSec: "Privatize Social Security." 1 – 7
- Answers to social political attitudes items ("Please indicate how much you agree with the following statements.")
  - Abortion: "Abortion is a women's [sic] right." 1 – 7
  - Marriage: "Marriage is between a man and a woman." 1 – 7

  - StemCell: "Stem cell research is moral and can be useful for science." 1 – 7
  - Marijuana: "Marijuana should be legal." 1 – 7
  - RestrictAbortion: "Laws should restrict abortion in all or most cases." 1 – 7

- Vote. "Imagine walking into the voting booth today. Who would you vote for in the presidential election?" Mitt Romney (republican) – Barack Obama (democrat)
- Donate. "For the next part of the study we will donate $1 to the presidential campaign of your preferred candidate. Please indicate which candidate's campaign you would like us to donate $1 to." Mitt Romney — Barack Obama
- Start Date Next. The research material we received does not contain a question about the variable. Durante et al. (2013) write that they asked participants to indicate the expected start date of their next menstrual period in both studies, but only the data file for Study 2 contained this variable. This variable was included in the data file, but it was not used in Durante et al.'s (2013) analyses.

Processed Data

Study 1

The data file we received contained the following processed variables.

- Religiosity Score. Average of Rel1, Rel2 and Rel3
- Cycle Day. Variable indicating each participant's estimated cycle day, ranging from 1 to 28. There was no documentation on how this variable was calculated, but we managed to reconstruct this variable using the following rules:
  - Cycle Day = 28 minus Days Before Next Menstrual Onset (Cycle Day $< 1 = 1$, Cycle Day $> 28 = 28$)
  - Days Before Next Menstrual Onset = Next Menstrual Onset minus Date Testing
  - Next Menstrual Onset = Start Date of Last Period plus Computed Cycle Length

  - Computed Cycle Length = Start Date of Last Period minus Start Date of Period Before Last

- Fertility. Variable indicating each participant's fertility (high or low) based on Cycle Day. High = Cycle Day 7 – 14; Low = Cycle Day 17 – 25.

- Relationship Status. Variable indicating each participant's relationship status based on the raw variable Relationship. Single =response option (1) or (2); Married = response option (3) or (4).

- Cycle Day Testing. There was no documentation on how this was calculated, but we managed to reconstruct it as Date Testing minus Start Date of Last Period plus 1. This variable was not directly used in Durante et al.'s (2013) analyses. It might have been used as an intermediate step in the calculation of Cycle Day using other rules than the ones described above.

Study 2

The processed variables in the data file were the same as in Study 1, plus the following.

- Fiscal Political Attitudes Score: Average of FreeMarket, PrivSocialSec, RichTax, StandaardLiving and TooMuchProfit.
  Note: For some of the fiscal political attitudes items (e.g., Profit), answers were first reversed, such that higher values indicated conservatism and lower values indicated liberalism.

- Social Political Attitudes Score: Average of Marriage, RestrictAbortion, Abortion, StemCell, and Marijuana.
  Note: For some of the social political attitudes items (e.g., Abortion), answers were first reversed, such that higher values indicated conservatism and lower values indicated liberalism.

- ConceptionProbability: Variable indicating each participant's conception probability based on the variable Cycle Day. This variable was not used in the analyses that we focus on in Steegen et al. (2016).
- Cycle Day: For all but two participants, we managed to reconstruct this variable using the same rules as in Study 1 (see above), after fixing some coding errors (see below).

Data Cleaning

Some raw variables contained obvious coding errors. For some values, it was possible to fix the errors, whereas for others, we could not provide fixes with reasonable confidence. In these cases, erroneous values were set to NA (not available).

- Some values of the raw variables Start Date of Last Period, Start Date of Period Before Last, and Start Date Next indicated the wrong year (i.e., something else than 2012, the year in which the questionnaire was filled out, such as 2010, 2011, 2013, 2022, 2912). In these cases, we fixed the year to 2012.
- For one participant, the Start Date of Last Period and the Start Date of Period Before Last were identical. In this case, we used the value of Cycle Day to fix the Start Date of Period Before Last.
- Some values of Start Date Next were before the date of testing, and so were obviously wrong. They were converted to NA.
- Some values of Cycle Length were unusually small (e.g., 4, 5, 6, or 7) or unusually large (e.g., 90, 40972, or 41035). They were converted to NA.
- Some values of Cycle Length were expressed using a range (e.g., 21-26, about 31 days, 40+). They were converted to NA.
- For two participants, we did not manage to recover the value of Cycle Day from the original data file. As this likely indicates a coding error in Start Date of Last Period

or Start Date of Period Before Last, these variables were converted to NA. This means that for these two participants, Next Menstrual Onset, and hence Cycle Day and Fertility, could only be determined under NMO3 from Table 1 in Steegen et al. (2016). However, when Cycle Day was determined based on NMO1 from Table 1 in Steegen et al. (2016), we used the processed variable Cycle Day from the original data file for the assessment of fertility to ensure that the results of our single data set analysis are identical to the single data set analysis in Durante et al. (2013), despite these coding errors.

References

Durante, K. M., Rae, A., & Griskevicius, V. (2013). The fluctuating female vote: Politics, religion, and the ovulatory cycle. *Psychological Science*, *24*, 1007–1016.

Steegen, S., Tuerlinckx, F., Gelman, A., & Vanpaemel, W. (2016). Increasing transparency through a multiverse analysis. *Perspectives on Psychological Science*.