



# Cognitive Dynamics of a Single Subject: 1428 Stroop Tests and Other Measures in a Mindfulness Meditation Context Over 2.5 Years

DATA PAPER

MATTI TOIVO JUHANI HEINO 

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## ABSTRACT

Recent discussions on threats of group-to-individual generalisability in psychology have prompted the need for individual-level data that is of sufficient length, in order to study within-individual psychological processes. In the current study, a single participant monitored their own cognitive dynamics daily before and after a 20-minute meditation session delivered by a mobile application. Over the course of 900 days, the participant performed Stroop tests and self-reported variables regarding cognitions (e.g. mood, clarity, calm, tiredness) as well as context (e.g. sleep, fasting, coffee, self-regulation).

## CORRESPONDING AUTHOR:

**Matti Toivo Juhani Heino**

University of Helsinki,  
University of Tampere, FI  
[matti.tj.heino@gmail.com](mailto:matti.tj.heino@gmail.com)

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## KEYWORDS:

N-of-1; Stroop; meditation;  
fasting; sleep; self-regulation

## TO CITE THIS ARTICLE:

Heino MTJ. (2022). Cognitive Dynamics of a Single Subject: 1428 Stroop Tests and Other Measures in a Mindfulness Meditation Context Over 2.5 Years. *Journal of Open Psychology Data*, 10: 6, pp. 1–4  
DOI: <https://doi.org/10.5334/jopd.51>

## (1) OVERVIEW

### CONTEXT

The author collected their own data independently.

### COLLECTION DATE(S)

1.7.2014 – 22.12.2016

### BACKGROUND

As most of psychology involves so-called non-ergodic processes, large-sample research cannot provide reliable information about individual-level processes [1–4]. In addition, psychological phenomena are often non-linear, and time series can display long-range correlations as well as fractal scaling, implying the need for lengthy (magnitude ranging from a hundred to thousands) repeated measurements [5–7]. Due to these two issues in studying psychological dynamics, individual-level data of sufficient length is required to study the processes in question.

As a response to the aforementioned challenges, in recent years, so-called N-of-1 studies have been rapidly gaining in popularity [8, 9]. The rationale is, that social psychological phenomena are not only complex and multicausal, but manifest idiosyncratically. Hence, it can be highly ineffective for interventions to “smooth over” individual differences and focus on static commonalities alone – which, in turn, calls for new kinds of designs, including person-specific tuning such as is done in Just-In-Time Adaptive Interventions [10]. To build a robust theoretical base for such novel idiographic designs, understanding facets of the temporal evolution of the process in question is invaluable, although currently underdeveloped [11].

The current paper describes data collected by a single individual, as a means of personal insight into one’s cognitive dynamics; resembling the process described in [12] (i.e. what is known in the literature as real-time monitoring of an idiographic system [13]). Data collection was motivated by a goal to establish a stable daily mindfulness meditation practice, and included both self-reported cognitions (e.g. levels of clarity, calm and tiredness) as well as more physical factors (e.g. reaction time test, hours slept on previous night). Due to resource constraints, the data was never formally analysed, nor used in research projects.

The dataset provides time series of sufficient length to study the dynamics of and coupling between the assessed variables. It also allows for exploring, whether these dynamics are affected by disturbances (e.g. meditation retreats and conference visits) on daily routines.

## (2) METHODS

### SAMPLE

Participant, who is also the author, was a 33-year-old male doctoral student, who collected the data

independently in Southern Finland from 1.7.2014 to 22.12.2016. Location of data collection was mostly at home, but occasionally elsewhere (nearly exclusively at the office); this is indicated in the data.

### MATERIALS

Stroop test [14, 15] used was an online version available at [www.onlinestrooptest.com](http://www.onlinestrooptest.com). It is originally a neuropsychological test used to assess the ability to inhibit cognitive interference. During the test, the participant aims to indicate the color in which the word is written, whether or not that matches the word itself (e.g. clicking a button labeled “green”, instead of that labeled “blue”, would be the correct answer when presented with the word “blue” in green font). The aim is to answer as accurately and quickly as possible. From the test, response times and mistakes were extracted.

Guided meditations from a subscription plan of [www.headspace.com](http://www.headspace.com) depicted 12 different vipassana-based monthly themes (“packages”, e.g. focusing on loving-kindness or mindful awareness) and the instructions varied each day (e.g. visualising compassion as a light, or noticing emotions). During the data collection period, all available content was visited twice.

Data is missing from ca. yearly week-long conference visits and meditation retreats, including one month-long retreat. Akin to [12], new variables (e.g. minutes of meditation during the day prior to data logging, time since last coffee or meal) were added as their potential relevance was hypothesised during the data collection process; e.g. Stroop test results are available from 718 days (performed twice daily, pre- and post-meditation).

Survey items “How clear do you feel right now”, “How calm do you feel right now” and “How tired do you feel right now” were devised based on idiographic importance and the Headspace program’s value proposition. Answers were collected on a scale of 1–10 in intervals of 0.25.

Mood was measured as a proportion of time spent in four categories, since the last measurement (Day Reconstruction Method; see supplementary material of [16]). Categories were “in a bad mood”, “a little low or irritable”, “in a mildly pleasant mood”, “in a very good mood”, and they always sum up to 1. “Previous entry” refers to either the time of the previous measurement point, or the last 24 hours, if the previous day was missed.

### PROCEDURES

Each day, at their convenience and when a computer was available, the participant logged in an online spreadsheet (which also included a randomisation script for meditation posture) cognitive and contextual variables before performing a Stroop test. Immediately after this, they performed a 20-minute guided meditation, directly after which they re-did the Stroop test. After logging the Stroop test results in a spreadsheet, they logged in post-meditation reports of the cognitive variables as well as

additional contextual variables such as whether they were suffering from after-effects of drinking alcohol, or had experienced a self-regulation failure on the current day.

### QUALITY CONTROL

The data also indicates when the quality of the data point has potentially been compromised, e.g. due to disturbances mid-session. Extensive qualitative diary entries concerning the setting, relevant events having taken place pre-session, as well as data collection notes, are available by request, but not shared publicly due to privacy concerns.

### ETHICAL ISSUES

This study was initiated and performed by the author, who provided informed consent.

## (3) DATASET DESCRIPTION

### OBJECT NAME

cognitive\_dynamics\_heino.csv

### DATA TYPE

Primary data

### FORMAT NAMES AND VERSIONS

CSV

### DATA COLLECTORS

MH from University of Helsinki devised the study and collected the data (including acting as the participant).

### LANGUAGE

English

### LICENSE

CC0

### EMBARGO

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### REPOSITORY LOCATION

[www.doi.org/10.17605/OSF.IO/W9V28](http://www.doi.org/10.17605/OSF.IO/W9V28)

### CODEBOOK LOCATION

<https://osf.io/s9q3x/>

### PUBLICATION DATE

11.01.2020

## (4) REUSE POTENTIAL

This dataset can be used by researchers interested in cognitive dynamics, or the effect of sleep, (intermittent)

fasting, or coffee (abstinence) on those dynamics. Methodologists may also be interested in studying long-term learning effects in the Stroop task. Due to the length of data, it is possible to explore non-linear scaling and perform fractal analyses. Data can also be used in teaching N-of-1 analysis methods, e.g. in relation to studying self-regulation.

Missing data ought to be treated appropriately depending on one's analytical approach. In some cases, it may be possible to only analyse "intact" chunks and compare those. If imputation is used, suggest reporting the results both with imputed data, and by ignoring missingness.

## COMPETING INTERESTS

The author has no competing interests to declare.

## AUTHOR AFFILIATION

**Matti Toivo Juhani Heino**  [orcid.org/0000-0003-0094-2455](https://orcid.org/0000-0003-0094-2455)  
University of Helsinki, University of Tampere, FI

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## PEER REVIEW COMMENTS

Journal of Open Psychology Data has blind peer review, which is unblinded upon article acceptance. The editorial history of this article can be downloaded here:

- **PR File 1.** Peer Review History. DOI: <https://doi.org/10.5334/jopd.51.pr1>

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Published: 14 April 2022

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