Video can make science more open, transparent, robust, and reproducible

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Abstract:

Amidst the recent flood of concerns about transparency and reproducibility in the behavioral and clinical sciences, we suggest a simple, inexpensive, easy-to-implement, and uniquely powerful tool to improve the reproducibility of scientific research and accelerate progress—video recordings of experimental procedures. Widespread use of video for documenting procedures could make moot disagreements about whether empirical replications truly reproduced the original experimental conditions. We call on researchers, funders, and journals to make commonplace the collection and open sharing of video-recorded procedures.

One Sentence Summary:

Open sharing of video recordings of experimental procedures can make science more transparent, robust, and reproducible.

Main Text:

Are published scientific findings robust and readily reproduced by researchers outside the original team? Researchers across fields are questioning the reproducibility of published findings (1-5). Such concerns have sparked vigorous debate about what reproducibility means (6), whether there is in fact a 'crisis' of reproducibility (7-9), and if so, what to do about it (8-10). Significant attention has focused on the reproducibility of results within our own field of psychological science, and so our own work is at stake in the debate.

We applaud recent efforts to bolster the transparency, openness, and reproducibility of scientific research, including widespread replications of published findings (11-12); pre-registration of studies (13); changes in review and publication practices (8, 14); new incentives to encourage reproducible practices (15-17); special procedures for computationally intensive research (18); and more open sharing of data, analysis code, and materials (19) to make results more findable, accessible, interoperable, and reproducible (2, 20). Fortunately, new web-based tools (e.g., the Open Science Framework, GitHub, Dataverse) make adopting open scientific practices relatively easy.

In addition, we argue that one simple, inexpensive, easy-to-implement, and uniquely powerful tool should be a "must-do" for researchers seeking to improve the reproducibility of behavioral and clinical research: Open sharing of video recordings of all experimental procedures.

Visual media—first film and now video—have been research mainstays in developmental psychology for decades (21-25). Video uniquely documents the interactions between people and their physical and social environment more completely than any other form of measurement. It captures when, where, and how people look, gesture, move, communicate, and interact. Video captures essential details about empirical procedures and the surrounding context that the most detailed, carefully written methods sections of scientific papers overlook or omit. Video reveals how people gave consent to participate in research, the instructions to participants, the tasks participants or lab animals performed, and how, when, and where the

1 research took place. It records what research staff did and how they did it. Video can record
2 procedures in the laboratory, classrooms, museums, at home, or in public. Computer-based
3 tasks or displays used in laboratory research can be stored and shared through video.

4 Imagine being able to experience experimental tasks from a participant's perspective—what
5 they saw and heard and when—and being able to observe exactly how a particular procedure
6 was carried out. Consider some examples from developmental psychology. Do children really
7 use "mental abacuses" to calculate sums (26)? Yes, they do (27). Do toddlers really make
8 "scale errors"—believing that they can sit in tiny doll-sized chairs (28)? See for yourself (29).
9 Are infants "afraid" when they cross narrow bridges over precipitous heights (30)? You decide
10 (31). If a picture is worth a thousand words (23), then surely a video is worth a thousand
11 pictures (21). Video makes behavior "as tangible as tissue" (22).

12 Despite the virtues of video, no field, including developmental psychology, has yet made
13 commonplace the widespread sharing of research video. Still, the rapid progress in tools for
14 open science gives us ample reasons for optimism about the future.

15 One of these tools is the Databrary (databrary.org) digital library. Databrary went live in 2014
16 with support from the National Science Foundation and the National Institute on Child Health
17 and Human Development. Databrary specializes in the storage, management, sharing, and
18 reuse of research video. As of early 2017, some 740 researchers representing more than 287
19 institutions across the globe have been granted secure access to 6,900 hours of recordings of
20 more than 6,700 infant, child, and adult participants. Databrary addresses many of the barriers
21 that limit data sharing (32, 33) and tackles the thorny issues specifically related to video (34).
22 Formal institutional agreements restrict access to potentially identifiable video data. Only
23 researchers who demonstrate ethics training and gain institutional authorization are granted
24 access. Videos with individual faces or voices are shared only with explicit permission from
25 participants. Researchers decide what to share, with whom, and when. Datasets can be
26 accompanied by additional metadata that allow site-wide search and filtering operations. The
27 system stores preservation copies of videos in their original formats alongside a transcoded
28 version suitable for web-based playback. Databrary is committed to making the system a home
29 for the long-term storage, management, sharing and reuse of video with support from the
30 project's leaders who represent a diverse array of constituencies in open science
31 (<https://databrary.org/community/board.html>).

32 Stepping back, we see no reason to believe that psychological science is inherently less robust
33 or reproducible than other sciences. Rather, psychological scientists have simply cast an early
34 and more public spotlight on the field's challenges. We agree with the founders of the new
35 Society for Improving Psychology (35) that this public spotlight creates an opportunity to realize
36 meaningful change. And, we argue that video can improve reproducibility in other areas of
37 science.

38 So, in that spirit we invite our colleagues to join us in making the open sharing of video
39 recordings a standard operating practice across science, whether using Databrary, other
40 repositories (OSF, Dataverse, ICSPR, DataDryad), or the video-based *Journal of Visualized*
41 *Experiments (JOVE)* that is specifically dedicated to open communication about scientific
42 methodology. Videos of procedures can and should be viewed as the gold standard of
43 documentation. Indeed, the use of video for documenting procedures could make moot many
44 disagreements (36, 37) about whether replications (11, 12) truly reproduced the original
45 experimental conditions. More broadly, the widespread sharing of video recordings will
46 substantially bolster the openness, transparency, and reproducibility of science while making
47 findings more accessible and engaging to a public hungry for meaningful and robust insights
48 about the phenomena we study.

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5

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7 **Supplementary Materials:**

8 Videos cited (21, 23, 25) may be viewed by researchers who have formal authorization from
9 their institutions to access the identifiable research materials on Databrary.
10