OpenMTurk:

An open-source administration tool for designing robust MTurk studies

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Abstract

We present a free and open-source administration tool for managing research studies using Amazon's Mechanical Turk (MTurk). We call this tool *OpenMTurk* and it builds upon existing tools such as MTurkR and PsiTurk by sidestepping the need for computer programming and command line code. OpenMTurk allows even novice researchers to leverage MTurk's application programming interface to increase efficiency and research design. OpenMTurk is an easy to use graphic user interface that can run on Windows, MacOS, and Linux. It helps researchers launch studies using small batches, which can improve the representativeness of samples and reduce fees from 40% to 20% of worker compensation. OpenMTurk also allows researchers to efficiently communicate with workers, administer worker bonuses, and ban/unban workers. These features can help researchers run follow-up or longitudinal studies or efficiently administer studies with monetary incentives. OpenMTurk also solves a few potential concerns with TurkPrime: The source code is available for everyone, which means there are no fees, no future possibility of fees for any feature, and no unnecessary third-party data collection. Additionally, users are free to suggest new features, and technically inclined users are free to learn and contribute new source code.

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Amazon's Mechanical Turk (MTurk) marketplace provides access to a global workforce able to perform surveys, language translation and transcription, and evaluating website content (Buhrmester, Kwang, & Gosling, 2011; Horton, Rand, & Zeckhauser, 2011; Mason & Suri, 2012). MTurk is popular among researchers that study human behavior and cognition because it produces high quality data rapidly and at a relatively low cost (Buhrmester et al., 2011). MTurk also features thousands of active workers (Crump, McDonnell, & Gureckis, 2013) from a variety of ethnic and class backgrounds, and therefore provides access to samples normally illusive to researchers in social and organizational sciences (Landers & Behrend, 2015).

Although MTurk is widely used and has a fairly researcher-friendly platform, there are a number of advanced programming interface features that MTurk "requesters" without particular programming skills would likely find difficult to navigate. As a consequence, various third-party tools, such as TurkPrime, have been created to facilitate the use of MTurk's advanced features for a broader array of researchers. However, there are several problems with the presently available third-party tools and, as such, we have developed a new and open-source MTurk administration tool, *OpenMTurk*, that we believe will be of use to researchers.

We will introduce our new MTurk administration tool by first reviewing different methods researchers can use the MTurk interface and why accessing MTurk's advanced programming interface is so important. Second, we will review third-party tools such as TurkPrime, PsiTurk, and MTurkR that researchers can use to access MTurk, but also note some critical limitations with these existing tools. Finally, we will review how OpenMTurk addresses these limitations and provide some examples of how the tool can be used.

Accessing Mechanical Turk

Researchers can create studies with MTurk in three ways. The first method is through the MTurk website as a "requester"—that is, someone looking for workers (Amazon Web Services, 2018c). This method is sufficient to create basic surveys and collect large samples. Researchers can login, create a new assignment, and link a survey—reaching thousands of participants in just a few days. However, for more advanced tasks, the requester website is often frustratingly inefficient. To e-mail workers, for example, a researcher needs to find each worker on the site (which are anonymized but can found through unique MTurk user IDs), click to message them, write the title and body, and then click send. Thus, inviting users for a follow-up study can take hours or days with large sample sizes. Worse, if the original study expires, the study and its participants are unavailable in the online interface, and researchers can no longer communicate with their workers.

But what about more advanced issues? For example, researchers may need to implement a longitudinal design in which MTurkers return for multiple sessions over time. Or it might be that the researcher is only looking for participation among a subset of the initial sample who meet specific criteria. MTurk has a "qualifications" feature that allows researchers to assign scores to individual users, but it has limited documentation and is designed for programmers (Amazon Web Services, 2018a). This feature can be used in studies by limiting access to the survey to only those above a certain cut-point, which is required to launch a study in small batches, which can be useful for increasing representativeness and reducing MTurk fees from 40% of worker compensation to 20% of worker compensation. However, navigating MTurk's "qualifications" feature is often a byzantine adventure and, for users with low programming experience, likely an insurmountable technical obstacle. Unfortunately, the requester site, which

is easily accessible, only has a small number of features available to users, which limits the types of studies scholars can run. Perhaps because of limitations with the difficult requester user interface, MTurk does have another method for launching studies—their "Application Programming Interface" (API). The API serves as a broker between researchers and MTurk's servers (Amazon Web Services, 2018a).[1]

MTurk's API empowers researchers to communicate directly with Amazon. The API is robust—it has tools unavailable to website users that augment research designs on MTurk and streamline repetitive administrative tasks (Amazon Web Services, 2018a). In just a few minutes, one can launch a study, restrict participation to participants from a previous study, and invite them by e-mail to a new one. The API allows one to pay everyone, provide performance bonuses, and block bad workers in one click (Amazon Web Services, 2018a). One can even access data from expired assignments—a feature that is unavailable on the requester website. For an individual study, the API can save researchers days and unencumbered them from repetitive and trivial tasks. Moveover, accessing the API may even help develop more advanced studies, and in turn, publications not possible using the requester website (Litman, Robinson, & Abberbock, 2017).

Amazon provides documentation for requesters about how to access the API and put it to use (Amazon Web Services, 2018a). However, the documentation may be too technical for many researchers with low programming experience and who are not intimately familiar with Java, Ruby, or C#. As a consequence, people have begun to create easy-to-use tools that researchers

[1] There is also a third method, the MTurk Command Line Interface, which lands somewhere in the middle of the requester user interface and the API (Amazon Web Services, 2018b). For the Command Line Interface, researchers need to download software and learn syntax, giving access to some additional tools. We do not discuss it in detail here as the API is more powerful *and* sidesteps the need for understanding complex syntax or programming.

can use to leverage the API. However, again, the existing tools have important limitations that we seek to resolve with OpenMTurk.

Third Party Programs that Utilize MTurk's API

TurkPrime was the first comprehensive tool that allowed researchers to utilize MTurk's API using a simple graphical user interface (Litman et al., 2017). The tool has six main advantages over the MTurk Requester Interface including improve user management, researcher control over studies, mechanisms to communicate and pay workers, study flow indicators, and a suite of tools to target specific workers and for study design (Litman et al., 2017). TurkPrime is powerful and easy to use, and as a result, has been used by over 5000 research teams and has surfaced in several published studies (Litman et al., 2017). Nonetheless, TurkPrime has some notable drawbacks.

The most critical issue is that TurkPrime is a proprietary program that is not open-source. As a consequence, TurkPrime monetizes features and free features today could become "premium" at anytime. For example, MTurk charges a 40% surcharge to studies with more than nine participants. TurkPrime has features to reduce this fee. TurkPrime offers a "microbatch" option, which allows a researcher to post their study in increments of nine participants (TurkPrime.com, 2018b). Once data collection for the first batch of nine participants is complete, TurkPrime posts a second batch, and so on, until data collection is complete. However, TurkPrime, charges a fee for this service, equivalent to 2 cents for each participant plus 5% of the worker's wages (TurkPrime.com, 2018a). It is important to note that there may be non-monetary reasons to use "batching," such as making tiered postings so that a study is available to a larger range of MTurk workers. There is evidence that there are differences between workers who participate at different times or on different days (Arechar, Kraft-Todd, & Rand, 2017).

Additionally, as a proprietary service, TurkPrime could begin charging for existing free features at any time. For example, the previously discussed "microbatch" feature used to be free, but became a premium feature on January 11th, 2018 (TurkPrime.com, 2018a). It could also be problematic if TurkPrime were to cease operations altogether. Since MTurk's requester interface does not allow researchers to access studies created and managed using the API (Amazon Web Services, 2018c), researchers would need to learn how to program so they could use the API to access previous studies.

Another issue is that, when TurkPrime posts studies, it links MTurkers to their own website where they are asked basic demographic questions and records IP addresses prior to being forwarded to the researcher's survey. This allows researchers using TurkPrime to, for example, view how consistently a worker provides the same gender response across studies by downloading their data from the dashboard. Additionally, TurkPrime sells this data as a premium feature, so researchers can, for example, include or exclude workers from specific regions based on their IP data. This is problematic because the participant may not consent to any of this and these processes may not be a part of the ethical clearance for individual research studies. After all, researchers have no control over how this data is used and the data could be used to prevent workers from participating in future studies, therefore limiting their earning potential. In sum, TurkPrime is a very useful tool to utilize mTurk, but there are both practical and ethical concerns for academic researchers.

Another option is PsiTurk, which is an open-source tool that eases the creation of online MTurk experiments (Gureckis et al., 2016). Researchers upload their code, which may involve completing surveys, manipulations, or even multi-player games. Once posted, other scholars can download their code and use it themselves for replication or for designing innovative studies that

build on the existing knowledge. Better yet, PsiTurk will host the study, so surveys and experimental manipulations are hosted on their servers. The service even includes their own open-source libraries to help facilitate experimental design. PsiTurk is a very useful innovation and can save researchers lots of programming time. Nonetheless, the service has some major limitations for researchers.

The first limitation is that PsiTurk is designed to run on UNIX-based systems and thus only works with users on Linux or MacOS, leaving Windows users without access (Litman et al., 2017). Second, although PsiTurk makes running and designing studies easier, it still requires understanding of command line interfaces and programming to use (Gureckis et al., 2016). This may serve as an obstacle for the researcher who simply intend to use MTurk's APIs for a typical survey study. Indeed, technological hurdles are a commonly cited reason for researchers not conducting their research online (Gureckis et al., 2016). Thus, PsiTurk is a valuable tool that has an important role in research, but has its own limitations.

A more similar tool to what we are proposing is MTurkR (Leeper, 2017), which is an open-source project connected to the open-source statistical software "R". MTurkR strives to provide easier and direct access to the MTurk API, but suffers from a notable limitation—the user must know R (the user must download R, install packages, and learn how to program R). To attempt and circumvent this problem, there is the MTurkRGUI, but this also requires downloading R, installing library packages, and learning to use a GUI that works within the R programming environment. This program is a step in the right direction, but requiring users to familiarize themselves with the R programming environment introduces a set of usability problems that can interfere with adoption, especially for those who are new to data management via programming (Ward, 2013). While there are many benefits to learning R, particularly for

data management reasons, there is no reason why knowing a particular programming language should be an obstacle to using the MTurk API.

OpenMTurk

The purpose of OpenMTurk is to give researchers the same level of access to MTurk that programmers at major technology companies enjoy, but using a simple graphical user interface more similar to SPSS or SAS, which are widely used in the medical and social sciences (Ward, 2013). Through this tool, researchers can launch new MTurk studies, communicate with workers individually or in bulk, pay or bonus workers, create worker qualifications for future studies, implement small batches to increase representativeness and reduce fees, and (un)ban MTurk workers using a point and click interface on their local computer. Together, OpenMTurk enables researchers to save time and money.

The program is built using java code and MTurk's publically available API. The primary advantage of using java code is that OpenMTurk can be run on most operating systems including Windows, MacOS, Linux, and Solaris. This means that the tool can be run locally from the researchers' computer and that workers are directly linked to the researcher MTurk account. This means that researchers and workers never have to provide data to an unnecessary third party. The open-source code is freely available on GitHub, which means that features will always be free. Better, because the codebase is open-source, researchers are able to contribute new code to the program. For example, if a researcher was graphically inclined, they could help refine the graphic user interface. If a researcher is pragmatically inclined, they could code new features and submit them. Those revisions, if accepted, are then freely available to everyone. Unlike PsiTurk, OpenMTurk does not require command line use or programming knowledge, and is suitable for

anyone conducting MTurk research. Thus, OpenMTurk addresses the major limitations of both TurkPrime and PsiTurk. In the next section, we review each of the program's major components.

Using OpenMTurk

Setting up OpenMTurk.

Installing OpenMTurk. If the researcher does not have Java installed on their computer, they can access Java free of charge from Oracle's website: https://java.com/en/download/. This is an executable file, so browsers will give downloaders a security warning. Oracle is a Fortune 100 company and java is widely used, so researchers can download and install this application with confidence. To access the compiled Java program or the source code for OpenMTurk, researchers can go to the following link: https://github.com/MVanBoxtel/OpenMturk/.

Initial Account Configuration (one time). If the researcher has never used the API before, they need to validate their MTurk credentials so that the program can use the API with their MTurk requester account (the same is true if one were to use TurkPrime or the other tools described above). This is done a few steps. First, the researcher needs to create an Amazon Web Services account (free tier) at http://aws.amazon.com/. Once an account is created, the researcher needs to create a "user" account for OpenMTurk to use. Amazon has provided a visual step-by-step guide of these instructions at: https://blog.MTurk.com/tutorial-setting-up-the researcherr-aws-account-to-make-use-of-MTurks-api-4e405b8fc8cb. The researcher needs to login to the AWS console, search for and then load "Identity and Access Management". From here, they will add a user by clicking on "Create additional IAM user" and then click on "Manage users". On the next page, click "Add user." Use the name "OpenMTurk" and check "programmatic access." On the next page, researcher need to select the **"**Attach existing policies

directly" tab and then select "AmazonMechanicalTurkFullAccess". Click on "Create User" to finalize user creation, and then the researcher is provided an access ID and a secret access key. The ID and secret access key are what enable OpenMturk users to create and manage studies using the researcher account. Therefore, it is important that the researcher copy and save this information for future reference. The researcher can only view the secret access key once, so if he or she loses it, they will need to start over and create a new IAM user. Finally, the researcher needs to link their Amazon Web Services account and their Mechanical Turk Requester account, so that the two services can work together. Instructions are illustrated in Step III of the mTurk guide linked above.

Initial OpenMTurk Configuration. To configure OpenMTurk, the researcher needs to open the program, go to the "Account Settings" tab, and enter the access ID and secret access key, and click "validate." The researcher will likely find the program in their 'downloads' folder or where they chose to save the file and can move the program anywhere on their computer. Each time the researcher opens the program, they will need to click "validation credentials". After a successful login, there will be a green indicator in the top right of the screen.

Using OpenMTurk

Creating New Studies. Creating a new MTurk study only takes a few minutes. Make sure the program is logged in by looking at the indicator at the top of the screen. Next, click on the "Create HIT" tab. Here, the researcher can fill in the title the researcher wants to advertise on MTurk, a description that users will read, how long the project will run (hours), the reward paid (dollars; e.g., 0.50 for fifty cents), the number of assignments, and if the researcher wants auto approval after workers complete the HIT (and, if so, how many hours after submission this is to be done). If the researcher leaves auto approval at none, the researcher will

manually need to approve work, which we describe under Managing Users. If the researcher would like the listing to link users to an external survey such as Qualtrics or SurveyMonkey, enter the URL in the "Study/Survey URL" box. Double check this link, since it is how users access the researcher's study. The researcher can also enter in necessary "qualifications" to participate. The researcher can use any one of MTurk's three standard qualifications (location, HIT approval, or raw number of approved HITs). For the country qualification, to select multiple countries, change the country dropdown to "In" or "NotIn".

The researcher can also check "Microbatch", which will divide a single study into separate small studies of nine workers. It uses the API to stop users from participating in more than one microbatch. This will reduce MTurk fees from 40% of worker compensation to 20% of work compensation, which can generate large savings. The one problem with this feature is that the users are then broken up into several smaller studies, which can add some additional user management. For example, to manually approve assignments or bonus workers, researchers will need to manually click through each microstudy. An efficient time work-around is to simply auto-approve projects, and then ban users who fail careless responding checks. This option may be best, since rejecting assignments can lead to negative reviews on MTurk worker websites and forums, reducing the researcher's ability to recruit workers (mTurk for Academics, 2015).

Managing Studies. The researcher can also view and revise existing live studies by going to the "Assignment Management" tab. Here the researcher can click "List Studies" and the application will download all of the researchers current and past studies. Then, the researcher can click on one and adjust settings, and then click "update." The researcher can also extend, pause, or resume a study by clicking "pause". Finally, the researcher can also delete studies from the same portal. The researcher will be asked for confirmation before posting or deleting studies.

Managing Users. Many of the most useful OpenMTurk features have to do with managing workers. The first feature is e-mailing or communicating with workers. To do so, open OpenMTurk and go to "Contact Workers" tab. Here, a researcher can enter in a title of their message, the message, and a list of MTurk worker IDs (enter each worker ID on a new line). Alternately, if the researcher does not have a list of Worker IDs, the researcher can list their assignments by title and e-mail all people within each assignment. The program will message each person in the list. Communicating with users can be useful to send reminders, feedback, or invite them to future studies. Next, a researcher can ban or unban users by clicking on the "Block/Unblock Workers" tab. Simply list their worker IDs and a reason, and then select "Ban Workers." The researcher can remove workers from the list in the same area.

Finally, the researcher can use OpenMTurk to pay workers for completed HITs. To do this, go to the "Assignment Management" tab, select a HIT, select users, and click approve—or reject. OpenMTurk will automatically link relevant assignment IDs. In addition to approving HITs, OpenMTurk can also facilitate paying bonuses or extra cash amounts to workers. This could be used to pay "cash prizes" as motivation incentives, such as when a researcher is trying to encourage higher levels of effort. The bonus feature can also be used to facilitate follow-up studies and payment without creating additional HITs. To do so, the researcher just needs to input the HIT IDs, Worker IDs, and bonus amount, and the click submit. The researcher can request Worker IDs and Assignment IDs survey-side or can access MTurk worker IDs and assignment IDs in the "Worker Bonuses" tab. If the researcher has this information in advance, they can import Worker IDS and Assignment IDs using a CSV file, which should be two columns without titles. If the researcher needs this information, they can list HITs, select them, and export the data to CSV. This data can then be merged into a dataset and used to allocate

bonuses. Once the researcher determines who to bonus, they would save the selected Worker IDs and corresponding Assignment IDs into a CSV file, and then import it into the application.

Conclusion

Amazon's Mechanical Turk (MTurk) is an increasingly common and influential resource for completing fast and highly powered psychological research. Nonetheless, MTurk has a number of useful features – such as the ability to access expired studies, or to easily contact participant – that are underused because they require researchers to use the "Application Programming Interface" (API), which, in turn, requires a degree of technical knowledge. There are, fortunately, alternative options available to researchers. Here we have introduced one such option – OpenMTurk – that has benefits over the other available options. In particular, it is an open-source and non-proprietary resource that unlocks the potential of the MTurk API (allowing for things such as "microbatching"), but at no additional cost or third-party data collection. Moreover, OpenMTurk is available on GitHub (https://github.com/MVanBoxtel/OpenMturk/) and is open to revision. That is, since the codebase is open-source, it is possible (and encouraged) for researchers to contribute new code to the program. Such revisions, if accepted, would then become then freely available to everyone. We believe OpenMTurk to be a useful tool for running studies on MTurk and hope that it will only become more useful in the future.

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