Growing body of evidence suggests that the tenants of transparency, openness, and reproducibility are lacking in the routine practice of scientific research (Nosek et al., 2015). Contributing to the problem of reproducibility is the pervasive nature of publication bias. Publication bias occurs when the results of a study negatively impact the probability of its publication (Carter, Schönbrodt, Gervais, & Hilgard, 2019). For example, if a replication study finds a nonsignificant result on a previously statistically significant effect, the researchers may be less likely to submit the finding for publication because of the likelihood of rejection by editors and reviewers. Publication in a scientific journal not only lends itself to coveted authorship, but more importantly, it makes the research data accessible to the research community. When nonsignificant findings go unpublished, the nonsignificant data becomes virtually invisible (Rosenthal, 1979). The result is an overabundance of published false positives, which leads to the distorted perception that good research is only as valuable as its statistically significant effect. In the end, many false positive studies end up becoming de facto truth, and future efforts to dispel the findings become challenging.

To better understand the depth of the reproducibility problem, social psychologist Brian Nosek (2011) led a project in collaboration with 270 contributors (Open Science Collaboration, 2015). The goal was to replicate 100 different psychological studies; an undertaking that came to be known as the “Reproducibility Project: Psychology.” The first report of findings was posted online in April 2015, and found that, of the 100 studies, only 36 successfully replicated. Unique characteristics of the project included the preregistration of research plans, public archival of data and materials, and the development of software driven scripts for statistical analysis, written using the R programming language. R is a free open source programming language and statistical computing environment that allows researchers to clean, analyze, and graph data (R Core Team, 2018). It is an important tool that can be used across a variety of disciplines for both research and teaching purposes. The use of these scripts ensured consistency across all 100 studies and made the complete analysis of the data reproducible. There are many reasons to learn R, but the reproducibility project established its utility in the promotion of transparency, collaboration, and most importantly reproducibility.

By publicly archiving research materials and data, researchers make nonsignificant findings visible, and free open source software (such as R) allows researchers to explore and reproduce the statistical analysis without the high cost of propriety software. Despite these benefits, many researchers are still hesitant to switch from (or complement) their current methods. Anecdotally, resistance to

**Learning R Programming Language With Psi Chi**

April Staples †, Weatherford College; and Jordan R. Wagge ‡, Avila University

**ABSTRACT.** Public archival of research materials and the use of free open software such as R programming language help promote the tenants of transparency, openness, and reproducibility. For many, learning a programming language can be overwhelming. Recognizing the need for a fun and engaging learning project, the Psi Chi Research Advisory Committee (RAC) decided to establish the PsiChiR contest. The goal of the contest is to provide an opportunity for users of all levels to practice and further develop their R skills. The first PsiChiR contest launches March 2020.

**Keywords:** R programming, research methods, statistics, conducting research, open science
R Programming With Psi Chi | Staples and Wagge

using R might be rooted in the perception of a steep learning curve—not just for students, but for statistics instructors as well as other faculty in the department who work with student research assistants. The merits of using R, SPSS, or a myriad of other statistical analysis tools is a separate, dynamic conversation that is frequently held in many spaces wherever teachers of psychological statistics gather (e.g., online, at conferences, in journals). Therefore, this is a conversation that (for the most part) we will avoid here. One of the functions of the Psi Chi Research Advisory Committee (RAC; https://www.psichi.org/ResearchAdvisory) is to help members build research skills. Our committee members’ experiences as professionals mirror the anecdotal experiences expressed by colleagues who want to learn R but do not have the time. So, several years ago, seeing the value in R, the RAC began exploring ways to introduce the programming language and provide learning opportunities to our membership.

Our first step was to compile an R resource list for members. This list provided links to other online sources and books that members of the RAC found helpful in developing their own skill with R. The struggle with a static list of resources, though, is that the resources change so frequently, are geared toward different types of scientists, and have so many different points of entry that its helpfulness is limited. In thinking through the best way to support our members’ R learning, we decided the next step was to develop a regularly occurring contest for members that contained multiple points of entry to build competence in R and promote participation in the larger R community.

One of the most valuable aspects of R is its vibrant, open community of users, which can be experienced by searching the hashtag #rstats on Twitter. Using this hashtag, students, researchers, developers, writers, and collaborators work together to solve programming problems and participate in a variety of social projects. One of the most popular social projects in R is a weekly project known as #TidyTuesday. This project was established with the primary goal of connecting mentors and learners (Mock, 2018). Each week, a link with a new data set is released on Twitter, and participants attempt to create or copy a visualization of that data. This is a lot of fun and a wonderful resource for those who have even basic knowledge of the R programming language; however, for individuals who are completely new to R programming, it can be intimidating. The goal of the R contest established by the RAC is to provide a similar opportunity for Psi Chi members to engage in a social project with no or minimal experience using R. Additionally, the contest provides the opportunity for members with more experience to refresh and further develop their own R skills.

The rest of this editorial presents the general guidelines for this forthcoming contest, PsiChiR. We invite you to read, get excited, and then participate. You may win a laptop sticker, and you will definitely learn some R.

Contest Guidelines

On the first of every month (starting in March 2020) we will release a link to a public dataset with instructions for participants to write code that accomplishes some goal. There will be four levels of goals (see Table 1 for a description of these levels along with examples of tasks)

To submit a response for a level, participants must submit all lower levels. Participants who submit correct responses (correct at ALL levels submitted) will be entered into a contest for a laptop sticker for that level (see Figure 1).

<table>
<thead>
<tr>
<th>Level</th>
<th>General Task Description</th>
<th>Example of Specific Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Date Processing</td>
<td>Remove cases with missing values on X variable</td>
</tr>
<tr>
<td>2</td>
<td>Descriptive Statistics</td>
<td>Find means and standard deviations for specific variables</td>
</tr>
<tr>
<td>3</td>
<td>Data Visualization</td>
<td>Create a plot to visualize the differences in means between X and Y groups on Z variable</td>
</tr>
<tr>
<td>4</td>
<td>Inferential Statistics</td>
<td>Perform a t test to test the hypothesis that the means of X and Y groups are different</td>
</tr>
</tbody>
</table>

Figure 1. A sample laptop sticker for the March 2020 contest winner.
Contests will be released on the first of each month, with submission deadlines on the 15th (submissions won’t be accepted past the 15th (anywhere on earth). The RAC will then look through the responses and post correct responses for each level, along with their authors’ names and institutions, on a public forum by the 22nd of each month. After that, the RAC will work on getting the next contest put together and posted. Contest details will be posted on the OSF page for this project (https://osf.io/f5zjr/), which will also serve as the central clearinghouse for all contest-related items.

We will primarily use data that is associated with Psi Chi in some way: open data from a publication in the {	extit{Psi Chi Journal of Psychological Research}, data from one of our Network for International Collaborative Exchange (NICE; https://www.psichi.org/ConductingResearch) projects, and so on. We will also use the same data for three contests (three months), with tasks increasing in difficulty at each level throughout the three-month rotation. Data for the first contest is from Cramblet Alvarez et al.’s (2019) paper on students’ relative abilities to recognize important figures from psychology’s history by those figures’ gender and racial identities.

The movement toward reproducibility and openness in the field is gaining in momentum, with R in particular being used by many researchers and instructors in both their labs and classrooms. We believe this contest will be a valuable learning experience for Psi Chi members at all types of institutions, ranks, and programming skill levels—a contest that folks can join at any time, but also use as motivation for distributed practice with the R language. We invite our readers to get involved in this exciting new project from Psi Chi’s RAC.

References

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We sincerely appreciate the hard work on the part of the following individuals who each completed at least one review in 2019. Without the assistance of such dedicated professionals, Psi Chi Journal would not be able to function. —Debi Brannan (Editor)

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