Journal of Visualized Experiments

Integrating computerized linguistic analysis and social network analysis to capture addiction recovery capital in an online community

--Manuscript Draft--

Article Type:	Invited Methods Article - JoVE Produced Video
Manuscript Number:	JoVE58851R2
Full Title:	Integrating computerized linguistic analysis and social network analysis to capture addiction recovery capital in an online community
Keywords:	addiction, recovery communities, online social interaction, social network analysis, computerised linguistic analysis
Corresponding Author:	Ana-Maria Bliuc Western Sydney University Sydney, AUSTRALIA
Corresponding Author's Institution:	Western Sydney University
Corresponding Author E-Mail:	A.Bliuc@westernsydney.edu.au
Order of Authors:	Ana-Maria Bliuc
	Muhammad Iqbal
	David Best
Additional Information:	
Question	**Response**
Please indicate whether this article will be Standard Access or Open Access.	Standard Access (US$2,400)
Please indicate the **city, state/province, and country** where this article will be **filmed**. Please do not use abbreviations.	Sydney, New South Wales, Australia

TITLE:

Integrating Computerized Linguistic and Social Network Analyses to Capture Addiction Recovery Capital in an Online Community

AUTHORS & AFFILIATIONS:

Ana-Maria Bliuc[1], Muhammad Iqbal[2], David Best[3]

[1]School of Social Sciences and Psychology, Western Sydney University, Australia
[2]Institute for Sustainable Industries and Liveable Cities (ISILC), Victoria University, Melbourne, Australia
[3]Centre for Regional Economic and Social Research, Sheffield Hallam University, United Kingdom

Corresponding Author:

Ana-Maria Bliuc (a.bliuc@westernsydney.edu.au)

Email Addresses of Co-authors:

Muhammad Iqbal (muhammad.iqbal@vu..edu.au)
David Best (d.best@shu.ac.uk)

KEYWORDS:

online social interaction, online community, addiction, recovery, supportive networks, social identity

SUMMARY:

The article describes a novel approach for analyzing dynamic online social interactions (in an online context) exemplified by a study of an online community of recovery from alcohol and drug addiction.

ABSTRACT:

The article describes a new methodology designed with the aim of finding a comprehensive, unobtrusive, and accurate way of capturing social recovery capital development in online communities of recovery from alcohol and drug (AOD) addiction. Recovery capital was conceptualised as both engagement in the online recovery community and identification with the community. To measure recovery capital development, naturally occurring data were extracted from the social media page of a specific recovery program, with the page being set up as a resource for a face-to-face recovery program. To map engagement with the online community, social network analysis (SNA) capturing online social interaction was performed. Social interaction was measured through the linkages between the online contributors/members of the online community as represented by program clients, staff, and supporters from the broader community. To capture markers of social identification with the online community, computerised linguistic analysis of the textual data (content from posts and comments) was conducted. Recovery capital captured in this way was analysed against retention data (a proxy outcome indicator), as days spent in the (face-to-face) recovery

program. The online data extracted was linked to participant data in regards to program retention to test prediction of a key recovery outcome. This approach allowed the examination of the role of online support communities and assessment of the association between recovery capital (developed via the online community of recovery) and recovery outcomes.

INTRODUCTION:

The presented method has been designed to capture alcohol and other drugs (AOD) addiction recovery capital in online contexts. In the field of addiction, recovery capital has been defined as "the sum total of one's resources that can be brought to bear on the initiation and maintenance of substance misuse cessation"[1]. Recovery capital has been primarily measured through self-reports[2,3] in face-to-face contexts. This approach provides an alternative method of measuring recovery capital in online contexts by capturing the quality and quantity of online interactions in online communities of recovery.

Given the steady increase in the use of online resources in the form of peer-support in a range of health-related issues[4,5], it is necessary to develop new methods to capture the quality of these resources. Online peer support occurs in the form of social interactions in online forums and communities. Supportive social interactions in these online contexts contribute to building recovery capital, which in turn has a positive impact on the recovery process[6,7]. The method proposed presents a number of advantages over alternative methods. Firstly, it overcomes some of the limitations involving the use of self-report measures in addiction research, particularly around recall and self-presentational biases. While self-report measures are considered to have reasonable levels of reliability and validity, they are susceptible to biases and inaccuracies. To enhance accuracy and minimize bias, it has been recognized that there is a need to increase the use of novel measures and data collection situations designed to avoid or minimize these issues[8]. By accessing data naturally occurring in contexts where people in various stages of recovery interact spontaneously, and by using analysis methods that can extract meaningful information from these data (able to capture indicators of psychological states), biases due to social desirability (self-presentational) and inaccuracies due to limitations in recall can be reduced or even eliminated. Secondly, this method is highly efficient and cost-effective, as it relies on the extraction of already existing online data (i.e., in open online forums that are publicly accessible).

Described next is the method that was applied to a study of building recovery capital in an online community established to complement a traditional, face-to-face addiction recovery program for addicts in early recovery stages. In this case, online (social media) data were linked to program retention data, but the method can be also used in cases where linkage data is not available or accessible.

PROTOCOL:

The research described here was approved by the research ethics community at Sheffield Hallam University.

1. Setup

NOTE: Please refer to the attached R script provided as **Supplementary File 1**.

1.1. Load required packages (Rfacebook[9], dplyr[10], igraph[11], and openxlsx[12]) in R. Packages refer to functions, datasets, or compiled code that allow users to analyze, transform, or extract data.

1.2. Load (external) retention and user data into R as a data frame from a CSV file.

NOTE: Retention data refers to the number of days in which a client participates in the offline (traditional) addiction recovery program. It was provided by the administrator of the (offline) recovery program as recorded onto a CSV file with the participant name and number of days they have been involved in the program. The participant name was replaced by the anonymous ID number prior to being imported into R.

2. Data extraction from the online community (the social page of an addiction recovery community)

NOTE: This protocol applies to a social media page, but it can be adapted to different types of online communities. In the case of the Rfacebook package, it allows the user to extract data from the social media page into R.

2.1 Create a social media (Facebook) access token by following the guide on the referenced website[13].

2.2. Create access token in R.

2.3. Using the "getGroup" function from Rfacebook, extract data from the social media page of the community of interest (e.g., content of post, number of comments and likes for each post, a unique ID number for each post, etc.). This data is then saved as a data frame.

NOTE: A data frame is essentially a table within R used to store data.

2.4. Using the "getPosts" function from Rfacebook, along with the Post IDs extracted in step 2.3, extract data about posts likes made on the page.

2.5. Using the "getPosts" function from Rfacebook, along with the Post IDs extracted in step 2.3, extract data on the comments made on each post (e.g., user IDs of people commenting the post, when the comment was made, how many likes the post received). This data is then saved as a data frame.

2.6. Using the comment IDs extracted in step 2.5, extract data on the "comment likes" made on each post (e.g., user IDs of people liking the comment). This data is then saved as a data frame.

2.7. Combine the posts, post likes, comments, and comment likes data into one data frame.

2.8. Add a monthly breakdown (i.e., month 1 to 8).

3. Calculation of social media activity made and received by each client

3.1. Calculate the number of posts, comments, post likes and comment likes made by each client.

3.2. Calculate the number of posts, comments, post likes and comment likes received by each client.

3.3 Join the data frame of social media activity made and received by each client to the retention data frame.

3.4 Calculate the difference between posts and comments with likes and no likes.

3.5 Calculate the difference between posts with comments and no comments.

3.6 Join the likes difference data to the retention data.

3.7 Join the comments difference data to the retention data.

3.8 Calculate all the likes made by each client.

3.9 Calculate all the likes received by each client.

3.10 Identify which users did not participate in social media group (i.e., no activity).

4. Conducting social network analysis

4.1. Create an edge list. An edge list is a list of relationships within the social network, which in this case is based on 1) liking posts and comments and 2) commenting on posts. This is done by looking at two columns within the dataset. The first column contains the anonymous ID of the person making the post, while the second contains the anonymous ID of the person liking or commenting on the post.

4.2. Create a vertex list. A vertex list is a list of all individuals in the group. This is done by converting the two columns in the list of relationships into one column, and removing duplicate anonymous IDs so only the unique anonymous ID is left.

4.3. Using the “graph.data.frame” and “get.adjacency” functions in the igraph package, create graph and graph matrix objects from the edge and vertex lists.

4.4. Using the “degree” and “betweenness” functions from the igraph package, obtain the

network statistics (degree and betweenness) of the online group.

5. Conducting computerized linguistic analysis in LIWC

5.1. Export textual social media data (i.e., posts and comments) and post/comment ID column into CSV files.

5.2. Import the CSV files of textual social media data into the Linguistic Inquiry Word Count (LIWC) software.

5.3. Generate LIWC categories and save to new CSV files. Do this by clicking on “Analyze Text”, then on “Excel/CSV file”, and clicking on the column containing the posts and comments to select the text to be analyzed. After LIWC has completed analyzing the textual data, save the output as a new CSV file.

5.4. Import the LIWC results CSV file into R, and merge with existing data. The data is matched by the post/comment ID column, which exists in both LIWC and existing data frames.

5.5. Calculate total LIWC scores for each user in posts and comments, then join to the retention data.

5.6. Calculate total LIWC scores for each user in all textual data (post and comments combined), then join to the retention data.

5.7. Remove NAs from the retention data data frame.

6. Conducting regression analysis (to determine if indicators of engagement with the online community predict retention in the offline recovery program)

6.1. Define the independent variables.

6.2. Using the “lm” function in base R, conduct linear regression analysis using the retention data as the dependent variable, and LIWC categories, comments, post likes, and comment likes as independent variables.

6.3 Combine regression analysis results into one data frame.

7. Creating monthly SNA maps

7.1. Prepare data frames for SNA Maps.

7.2. Create an edge list based on monthly cumulative social media activity.

7.3. Create a vertex list based on monthly cumulative social media activity.

7.4. Create graphs and graph matrices based on monthly cumulative social media activity.

7.5. Set the layout of SNA maps based on cumulative social media activity.

7.6. Add colors based on user roles.

7.7. Create SNA maps and save them to a file.

8. Calculating monthly cumulative social media activity of the social media group

8.1. Calculate monthly cumulative social media activity by staff, clients, and other members of the social media group.

8.2. Calculate monthly cumulative social media activity by all members of the social media group.

8.3. Join the monthly cumulative social media activity data frames together.

REPRESENTATIVE RESULTS:

A detailed description of representative results obtained using this method can be found in our recent work[14], which was reviewed and received full approval from the research ethics committee of the institution at which the research was conducted. In the report described here, the study investigated whether online participation in a community of recovery contributes to the recovery process through recovery capital building (as captured by increased levels and quality of online social interactions and positive identity development). In other words, the study examined whether indicators of online recovery capital developed over the eight months of online data assessed and also predicted retention in a recovery program designed for fostering community involvement for addicts in early stages of recovery.

To map how participants interacted online, social network analysis (SNA) using data extracted from the social media page (n = 609) of a recovery community was conducted. A visual representation of the social network and its evolution is presented in **Figure 1**. The figure illustrates the activity in the online community observed each month for a period of 8 months in the form of connections between all participants in the online community (i.e., commenting on posts, liking posts, and liking comments). The number of connections that an "agent" in the network has determines how central they will be in the social network. Computerized linguistic analysis was used to assess the textual data (capturing social identity markers), and linear regression analysis was conducted to determine whether the indicators of recovery capital predicted program retention. These analyses indicated that program retention was indeed predicted by: (a) levels of group validation received in the form of comment likes and all likes received on the social media page, (b) position in the social network (network centrality), and (c) group identity and achievement (as captured by the linguistic content of online communication). The results supported the argument that, overall, positive social interactions

between members of an online recovery community are supportive of the recovery process. A summary of those findings is presented below.

[Figure 1 about here]

Descriptive statistics

Participants' levels of engagement with the online community were measured by computing the contributions of all participants in the online community as number of posts, comments, and likes made by staff, clients, and broader community members. **Table 1** presents a breakdown by type of contribution (as made by each category of participant) across 8 months.

[Insert Table 1 about here]

Determinants of retention in the program

The following hypotheses were tested: (1) program retention should be associated with indicators of recovery capital development (i.e., reflected in the quantity and quality of online interaction), and (2) program retention should also be associated with indicators of identity change, (i.e., indicators of positive recovery identity development). The quantity of online interaction was indicated by the a) number of posts made, b) number of comments made, c) number of post likes received, d) number of comment likes received, and e) number of all likes received.

To determine the quality of online interaction, network structure and language content were analyzed. More specifically, degree and betweenness coefficients derived from social network analysis (SNA) and linguistic indicators of positive affect derived from computerized linguistic analysis were used. As indicators of positive identity change (as identification with the recovery community) the frequency of use of the pronoun "we" and achievement words (e.g., try, goal, win, etc.) were used. Finally, the dependent variable (retention in the program) was indicated by the total number of days spent in the program (ranging from 86 to 464 days here). As shown by the results, levels of online interaction and in-group validation (as reflected by the number of likes received for posts and comments) predicted program retention (**Table 2**). Program retention was also predicted by identification markers (as captured by the use of the pronoun "we" in posts and of achievement words in both posts and comments). Finally, where participants are situated within the social network (i.e., degree of centrality) also represents an important aspect of retention (**Table 2**).

[Insert Table 2 about here]

FIGURE & TABLE LEGENDS:

Figure 1: Monthly representations of the social network of the online community over 8 months suggest changes in the pattern of social interactions between the participants. These representations illustrate how at the start, most of the client members in the online community (clients of the offline recovery program) are mostly disconnected, and it is the program staff

and only a small number of clients who drive the online activity. However, this gradually changes, so that after 8 months, the clients are the ones most connected (therefore the most central), with the highest number of connections in the network (figure is adapted from a previous publication)[14].

Table 1: **Shown is the number of online contributions by type (post and comments made, likes given to posts, and likes given to comments) by members of the online community on the across 8 months.** The members of the online community are classified as staff (support staff employed by the offline recovery program), clients (people in recover who are participating in the offline recovery program), and others (supporters and pro-recovery advocates from the broader community).

Table 2: **Retention time as predicted by online engagement, network statistics, and linguistic categories.**

DISCUSSION:

The approach described here is based on a new method of measuring how online group processes can impact retention in an addiction recovery program. Applying this method to an online community of recovery from addiction, it was found that there were four key aspects predicted program retention: being highly involved in the online community, being central in the online social network, positive affect expressed in communication with other members of the online community, and receiving validation from others for contributions to the network[14]. The findings obtained by using this method support existing theoretical models of recovery. That is, two key models in the recovery literature, the Social Identity Model of Recovery[15] and the Social Identity Model of Cessation Maintenance[16], both emphasize the importance of active participation in groups which are supportive of recovery. Both models suggest that increased identification and commitment to such groups contribute to lower future contact with using groups and consequent relapse.

As illustrated in our research, the method allowed us to map out trajectories of recovery or change of individual members of the online community[14]. Visualizations of the online social networks and their evolution over time can provide valuable information about the movement of members of the online community from the periphery to the center of the network and vice-versa (these movements in the network indicate changes in levels of engagement with the online community). In a 2017 study[14], interviews with members of the online community who undertook the most significant changes in terms of movement from the periphery to center of the networks were conducted as a way of triangulating our findings based on SNA, computerized linguistic analysis, and regression against retention data. Future studies may focus instead on those members who became disengaged with the online community, on those who never become engaged, or on more direct measures of outcome such as substance use and reoffending. This methodology can further fine-tuned to be used in intervention programs, for example, for assessing the role of moderators in help forums.

There are currently no studies providing evidence on the benefits of the method described here

when used by itself (the method described was used in conjunction with retention data and triangulated with qualitative data from interviews with key online community members[14]), but this approach can provide accurate and bias-free data that can complement self-reporting and other measures in studies of addiction recovery.

This method was applied to examine online social interactions in the context of a social media page established as a complementary form of support to a standard, face-to-face recovery program. However, with minor changes, the method can be used to investigate online social interactions in other types of online communities (online forums, discussion groups, chat rooms, commentary websites, etc.). One of the key advantages of this method is that it can be adapted and applied to contexts beyond communities of addiction recovery to any online community. For example, in our own political psychology research, we use a similar method (developed from the method described here) to capture the quality of online interactions and changes in these interactions between members of far-right online communities. In effect, the method can be applied to any online community in which data in the form of connections between members (as social network linkages) and linguistic content can be extracted.

However, in accessing and working with online data, researchers need to be aware of ethical issues, some which apply to self-reporting and other types of data in general and some which are only encountered in an online environment. In the research described here (which was approved by the research ethics community at Sheffield Hallam University), consent was obtained from the organization managing the recovery program, and strict measures were taken to ensure complete anonymity of participants in the open social media page (e.g., after online and retention data matching, all identifying information was removed from the files and also no potentially self-identifying quotes were used from the publicly accessible online communication).

Close communication with the organization also ensured that the participants in the program were aware of the study and research findings, and one of the researchers met regularly with the group to explain the study and its results. In other cases, however, where online communities are not associated with specific offline programs, it may be harder to determine who should be asked for consent regarding data extraction (applicable especially in unmoderated forums, where people in recovery seek online peer support). While the general principles of ethical research will apply, researchers need to adopt a case-by-case approach to ensure that the extraction and analysis of online data does not pose any significant risks to the participants (e.g., compromising privacy).

ACKNOWLEDGMENTS:
We are grateful to the clients and staff of Jobs, Friends and Houses, UK, who supported and agreed to participate in our research.

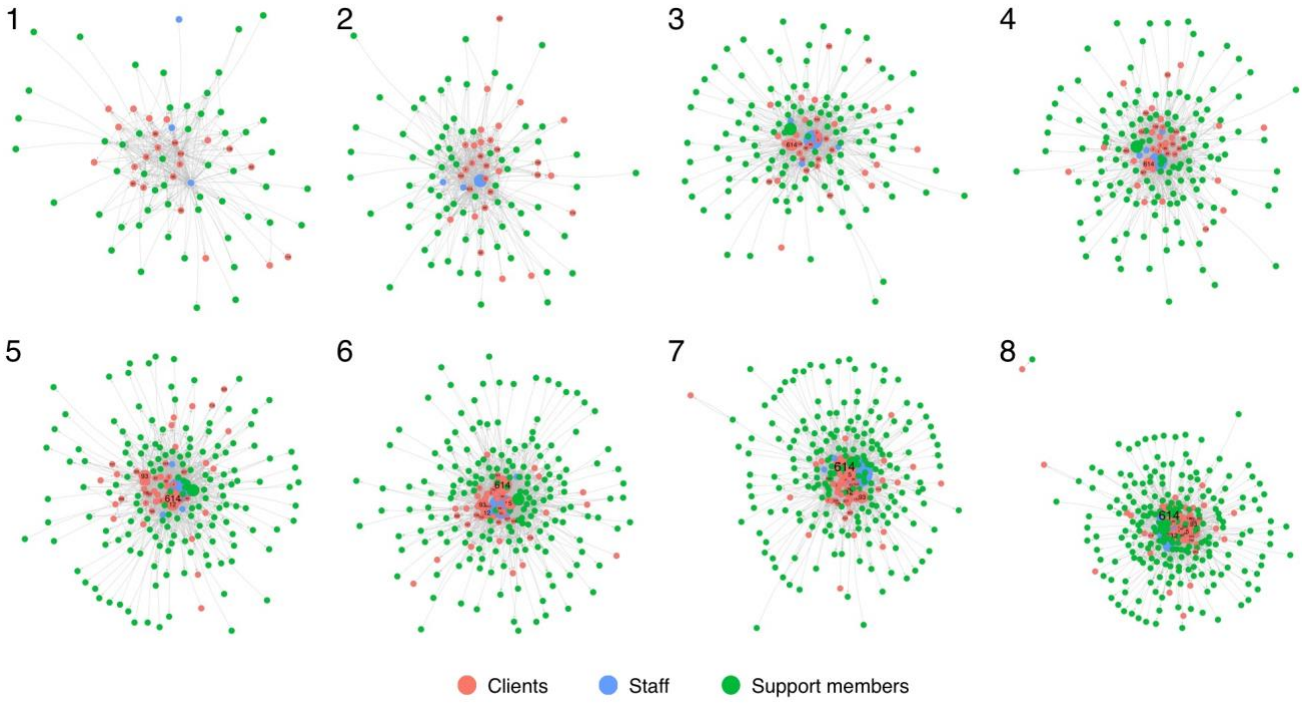
DISCLOSURES:
The authors have nothing to disclose.

REFERENCES

1. Cloud, W., Granfield, R. Conceptualizing recovery capital: Expansion of a theoretical construct. *Substance Use and Misuse*. **43**, 1971-1986 (2008).
2. Best, D. et al. Mapping the recovery stories of drinkers and drug users in Glasgow: Quality of life and its associations with measures of recovery capital. *Drug and Alcohol Review*. **31** (3), 334-341 (2012).
3. Laudet, A. B., White, W. L. Recovery capital as prospective predictor of sustained recovery, life satisfaction, and stress among former poly-substance users. *Substance Use and Misuse.* **43** (1), 27-54 (2008).
4. Moorhead, S. A. et al. A new dimension of health care: systematic review of the uses, benefits, and limitations of social media for health communication. *Journal of Medical Internet Research*. **15**, e85 (2013).
5. White, M., Dorman, S. M. Receiving social support online: implications for health education. *Health Education Research*. **16**, 693-707 (2001).
6. Best, D., Bliuc, A. M., Iqbal, M., Upton, K., Hodgkins, S. Mapping social identity change in online networks of addiction recovery. *Addiction Research and Theory*. **26** (3), 163-173 (2018).
7. Bliuc, A. M., Best, D., Beckwith, M., Iqbal, M. Online support communities in addiction recovery. A*ddiction, behavioral change and social identity: The path to resilience and recovery*. 137, (2016).
8. Del Boca, F. K., Darkes, J. The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction* **98**, 1-12 (2003).
9. Barbera, P., Package 'Rfacebook', https://cran.r-project.org/web/packages/Rfacebook/Rfacebook.pdf (2017).
10. Wickham, H., François, R., Henry, L., Müller, K. Package 'dplyr', https://cran.r-project.org/web/packages/dplyr/dplyr.pdf (2018).
11. Csárdi, G. Package 'igraph', https://cran.r-project.org/web/packages/igraph/igraph.pdf (2018)
12. Walker, A., Braglia, L. Package 'openxlsx', https://cran.r-project.org/web/packages/openxlsx/openxlsx.pdf (2018)
13. How to get a Facebook access token which never expires. <https://smashballoon.com/custom-facebook-feed/access-token/> (2018).
14. Bliuc, A. M., Best, D., Iqbal, M., Upton, K. Building addiction recovery capital through online participation in a recovery community. *Social Science and Medicine*. **193**, 110-117 (2017).
15. Best, D. et al. Overcoming alcohol and other drug addiction as a process of social identity transition: The Social Identity Model of Recovery (SIMOR). *Addiction Research and Theory*. **24**, 111-123 (2016).
16. Frings, D., Albery, I. P. The social identity model of cessation maintenance: Formulation and initial evidence. *Addictive Behaviors*. **44**, 35-42 (2015).

Figure

Click here to access/download;Figure;Figure 1_revised.pdf



Table

Group members	Type of online contribution	Month 1	Month 2	Month 3	Month 4	Month 5
All	Posts and comments	382	388 (770)	579 (1349)	369 (1718)	530 (2248)
	Post likes given	1167	878 (2045)	1856 (3901)	1440 (5341)	1880 (7221)
	Comment likes given	784	970 (1604)	825 (2429)	171 (2600)	634 (3234)
Staff	Posts and comments	129	106 (235)	170 (405)	96 (501)	185 (686)
	Post likes given	188	147 (335)	302 (637)	209 (846)	385 (1231)
	Comment likes given	168	303 (471)	237 (708)	69 (777)	168 (945)
Clients	Posts and comments	145	155 (300)	214 (514)	132 (646)	208 (854)
	Post likes given	365	252 (617)	415 (1032)	303 (1335)	549 (1884)
	Comment likes given	143	318 (461)	235 (696)	33 (729)	143 (872)
Others	Posts and comments	108	127 (235)	195 (430)	141 (571)	137 (708)
	Post likes given	614	479 (1093)	1139 (2232)	928 (3160)	946 (4106)
	Comment likes given	473	349 (672)	353 (1025)	69 (1094)	323 (1417)

Month 6	Month 7	Month 8
581 (2829)	796 (3625)	674 (4299)
1756 (8977)	2667 (11644)	1857 (13501)
970 (4204)	825 (5029)	171 (5200)
176 (862)	227 (1089)	316 (1405)
372 (1603)	567 (2170)	511 (2681)
303 (1248)	237 (1485)	69 (1554)
286 (1140)	419 (1559)	253 (1812)
529 (2413)	898 (3311)	576 (3887)
318 (1190)	235 (1425)	33 (1458)
119 (827)	150 (977)	105 (1082)
855 (4961)	1202 (6163)	770 (6933)
349 (1766)	353 (2119)	69 (2188)

Variable	*B*	*SE*	*β*	R^2
Comment likes received	0.43	0.18	.47*	0.22
Likes received (all)	0.08	0.03	.43*	0.18
Comment-like difference	1.09	0.5	.43*	0.19
Network degree	0.01	0	.43*	0.18
LIWC We (Post)	3.89	1.76	.43*	0.19
LIWC Achievement (Post)	0.56	0.26	.43*	0.18
LIWC Achievement (All)	0.14	0.07	.42*	0.17

Name of Material/ Equipment	Company	Catalog Number
LIWC software	Receptiviti	https://liwc.wpengine.com/
R software	n/a	https://www.r-project.org/

Comments/Description
computerised linguistic analysis software
free statistical and data visualisation sofware

jove JOURNAL OF VISUALIZED EXPERIMENTS
1 Alewife Center #200
Cambridge, MA 02140
tel. 617.945.9051
www.jove.com

ARTICLE AND VIDEO LICENSE AGREEMENT - UK

Title of Article:	Integrating computerized linguistic analysis and social network analysis to capture addiction recovery capital in an online community
Author(s):	Ana-Maria Bliuc, Muhammad Iqbal, David Best

Item 1: The Author elects to have the Materials be made available (as described at http://www.jove.com/publish) via:

☐ Standard Access ☒ Open Access

Item 2: Please select one of the following items:

☒ The Author is **NOT** a United States government employee.

☐ The Author is a United States government employee and the Materials were prepared in the course of his or her duties as a United States government employee.

☐ The Author is a United States government employee but the Materials were NOT prepared in the course of his or her duties as a United States government employee.

ARTICLE AND VIDEO LICENSE AGREEMENT

1. **Defined Terms.** As used in this Article and Video License Agreement, the following terms shall have the following meanings: "**Agreement**" means this Article and Video License Agreement; "**Article**" means the article specified on the last page of this Agreement, including any associated materials such as texts, figures, tables, artwork, abstracts, or summaries contained therein; "**Author**" means the author who is a signatory to this Agreement; "**Collective Work**" means a work, such as a periodical issue, anthology or encyclopedia, in which the Materials in their entirety in unmodified form, along with a number of other contributions, constituting separate and independent works in themselves, are assembled into a collective whole; "**CRC License**" means the Creative Commons Attribution 3.0 Agreement (also known as CC-BY), the terms and conditions of which can be found at: http://creativecommons.org/licenses/by/3.0/us/legalcode ; "**Derivative Work**" means a work based upon the Materials or upon the Materials and other pre-existing works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which the Materials may be recast, transformed, or adapted; "**Institution**" means the institution, listed on the last page of this Agreement, by which the Author was employed at the time of the creation of the Materials; "**JoVE**" means MyJove Corporation, a Massachusetts corporation and the publisher of The Journal of Visualized Experiments; "**Materials**" means the Article and / or the Video; "**Parties**" means the Author and JoVE; "**Video**" means any video(s) made by the Author, alone or in conjunction with any other parties, or by JoVE or its affiliates or agents, individually or in collaboration with the Author or any other parties, incorporating all or any portion of the Article, and in which the Author may or may not appear.

2. **Background.** The Author, who is the author of the Article, in order to ensure the dissemination and protection of the Article, desires to have the JoVE publish the Article and create and transmit videos based on the Article. In furtherance of such goals, the Parties desire to memorialize in this Agreement the respective rights of each Party in and to the Article and the Video.

3. **Grant of Rights in Article.** In consideration of JoVE agreeing to publish the Article, the Author hereby grants to JoVE, subject to **Sections 4 and 7** below, the exclusive, royalty-free, perpetual (for the full term of copyright in the Article, including any extensions thereto) license (a) to publish, reproduce, distribute, display and store the Article in all forms, formats and media whether now known or hereafter developed (including without limitation in print, digital and electronic form) throughout the world, (b) to translate the Article into other languages, create adaptations, summaries or extracts of the Article or other Derivative Works (including, without limitation, the Video) or Collective Works based on all or any portion of the Article and exercise all of the rights set forth in (a) above in such translations, adaptations, summaries, extracts, Derivative Works or Collective Works and (c) to license others to do any or all of the above. The foregoing rights may be exercised in all media and formats, whether now known or hereafter devised, and include the right to make such modifications as are technically necessary to exercise the rights in other media and formats. If the "Open Access" box has been checked in **Item 1** above, JoVE and the Author hereby grant to the public all such rights in the Article as provided in, but subject to all limitations and requirements set forth in, the CRC License.

4. **Retention of Rights in Article.** Notwithstanding the exclusive license granted to JoVE in **Section 3** above, the Author shall, with respect to the Article, retain the non-exclusive right to use all or part of the Article for the non-commercial purpose of giving lectures, presentations or teaching classes, and to post a copy of the Article on the Institution's website or the Author's personal website, in each case provided that a link to the Article on the JoVE website is provided and notice of JoVE's copyright in the Article is included. All non-copyright intellectual property rights in and to the Article, such as patent rights, shall remain with the Author.

5. **Grant of Rights in Video - Standard Access.** This **Section 5** applies if the "Standard Access" box has been checked in **Item 1** above or if no box has been checked in **Item 1** above. In consideration of JoVE agreeing to produce, display or otherwise assist with the Video, the Author hereby acknowledges and agrees that, subject to **Section 7** below, JoVE is and shall be the sole and exclusive owner of all rights of any nature, including, without limitation, all copyrights, in and to the Video. To the extent that, by law, the Author is deemed, now or at any time in the future, to have any rights of any nature in or to the Video, the Author hereby disclaims all such rights and transfers all such rights to JoVE.

6. **Grant of Rights in Video - Open Access.** This **Section 6** applies only if the "Open Access" box has been checked in **Item 1** above. In consideration of JoVE agreeing to produce, display or otherwise assist with the Video, the Author hereby grants to JoVE, subject to **Section 7** below, the exclusive, royalty-free, perpetual (for the full term of copyright in the Article, including any extensions thereto) license (a) to publish, reproduce, distribute, display and store the Video in all forms, formats and media whether now known or hereafter developed (including without limitation in print, digital and electronic form) throughout the world, (b) to translate the Video into other languages, create adaptations, summaries or extracts of the Video or other Derivative Works or Collective Works based on all or any portion of the Video and exercise all of the rights set forth in (a) above in such translations, adaptations, summaries, extracts, Derivative Works or Collective Works and (c) to license others to do any or all of the above. The foregoing rights may be exercised in all media and formats, whether now known or hereafter devised, and include the right to make such modifications as are technically necessary to exercise the rights in other media and formats.

7. **Government Employees.** If the Author is a United States government employee and the Article was prepared in the course of his or her duties as a United States government employee, as indicated in **Item 2** above, and any of the licenses or grants granted by the Author hereunder exceed the scope of the 17 U.S.C. 403, then the rights granted hereunder shall be limited to the maximum rights permitted under such statute. In such case, all provisions contained herein that are not in conflict with such statute shall remain in full force and effect, and all provisions contained herein that do so conflict shall be deemed to be amended so as to provide to JoVE the maximum rights permissible within such statute.

8. **Protection of the work.** The Author(s) authorize JoVE to take steps in the Author(s) name and on their behalf if JoVE believes some third party could be infringing or might infringe the copyright of either the Author's Article and/or Video.

9. **Likeness, Privacy, Personality.** The Author hereby grants JoVE the right to use the Author's name, voice, likeness, picture, photograph, image, biography and performance in any way, commercial or otherwise, in connection with the Materials and the sale, promotion and distribution thereof. The Author hereby waives any and all rights he or she may have, relating to his or her appearance in the Video or otherwise relating to the Materials, under all applicable privacy, likeness, personality or similar laws.

10. **Author Warranties**. The Author represents and warrants that the Article is original, that it has not been published, that the copyright interest is owned by the Author (or, if more than one author is listed at the beginning of this Agreement, by such authors collectively) and has not been assigned, licensed, or otherwise transferred to any other party. The Author represents and warrants that the author(s) listed at the top of this Agreement are the only authors of the Materials. If more than one author is listed at the top of this Agreement and if any such author has not entered into a separate Article and Video License Agreement with JoVE relating to the Materials, the Author represents and warrants that the Author has been authorized by each of the other such authors to execute this Agreement on his or her behalf and to bind him or her with respect to the terms of this Agreement as if each of them had been a party hereto as an Author. The Author warrants that the use, reproduction, distribution, public or private performance or display, and/or modification of all or any portion of the Materials does not and will not violate, infringe and/or misappropriate the patent, trademark, intellectual property or other rights of any third party. The Author represents and warrants that it has and will continue to comply with all government, institutional and other regulations, including, without limitation all institutional, laboratory, hospital, ethical, human and animal treatment, privacy, and all other rules, regulations, laws, procedures or guidelines, applicable to the Materials, and that all research involving human and animal subjects has been approved by the Author's relevant institutional review board.

11. **JoVE Discretion.** If the Author requests the assistance of JoVE in producing the Video in the Author's facility, the Author shall ensure that the presence of JoVE employees, agents or independent contractors is in accordance with the relevant regulations of the Author's institution. If more than one author is listed at the beginning of this Agreement, JoVE may, in its sole discretion, elect not take any action with respect to the Article until such time as it has received complete, executed Article and Video License Agreements from each such author. JoVE reserves the right, in its absolute and sole

jove JOURNAL OF VISUALIZED EXPERIMENTS
1 Alewife Center #200
Cambridge, MA 02140
tel. 617.945.9051
www.jove.com

ARTICLE AND VIDEO LICENSE AGREEMENT - UK

discretion andwithout giving any reason therefore, to accept or decline any work submitted to JoVE. JoVE and its employees, agents and independent contractors shall have full, unfettered access to the facilities of the Author or of the Author's institution as necessary to make the Video, whether actually published or not. JoVE has sole discretion as to the method of making and publishing the Materials, including, without limitation, to all decisions regarding editing, lighting, filming, timing of publication, if any, length, quality, content and the like.

12. **Indemnification.** The Author agrees to indemnify JoVE and/or its successors and assigns from and against any and all claims, costs, and expenses, including attorney's fees, arising out of any breach of any warranty or other representations contained herein. The Author further agrees to indemnify and hold harmless JoVE from and against any and all claims, costs, and expenses, including attorney's fees, resulting from the breach by the Author of any representation or warranty contained herein or from allegations or instances of violation of intellectual property rights, damage to the Author's or the Author's institution's facilities, fraud, libel, defamation, research, equipment, experiments, property damage, personal injury, violations of institutional, laboratory, hospital, ethical, human and animal treatment, privacy or other rules, regulations, laws, procedures or guidelines, liabilities and other losses or damages related in any way to the submission of work to JoVE, making of videos by JoVE, or publication in JoVE or elsewhere by JoVE. The Author shall be responsible for, and shall hold JoVE harmless from, damages caused by lack of sterilization, lack of cleanliness or by contaminationdue to the making of a video by JoVE its employees, agents or independent contractors. All sterilization, cleanliness or decontamination procedures shall be solely the responsibility of the Author and shall be undertaken at the Author's expense. All indemnifications provided herein shall include JoVE's attorney's fees and costs related to said losses or damages. Such indemnification and holding harmless shall include such losses or damages incurred by, or in connection with, acts or omissions of JoVE, its employees, agents or independent contractors.

13. **Fees.** To cover the cost incurred for publication, Jo VE must receive payment before production and publication the Materials. Payment is due in 21 days of invoice. Should the Materials not be published due to an editorial or production decision, these funds will be returned to the Author. Withdrawal by the Author of any submitted Materials after final peer review approval will result in a US$1,200 fee to cover pre-production expenses incurred by JoVE. If payment is not received by the completion of filming, production and publication of the Materials will be suspended until payment is received.

14. **Transfer, Governing Law.** This Agreement may be assigned by JoVE and shall inure to the benefits of any of JoVE's successors and assignees. This Agreement shall be governed and construed by the internal laws of the Commonwealth of Massachusetts without giving effect to any conflict of law provision thereunder. This Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall be deemed to me one and the same agreement. A signed copy of this Agreement delivered by facsimile, e-mail or other means of electronic transmission shall be deemed to have the same legal effect as delivery of an original signed copy of this Agreement.

A signed copy of this document must be sent with all new submissions. Only one Agreement is required per submission.

CORRESPONDING AUTHOR

Name:	Ana-Maria Bliuc
Department:	School of Social Sciences and Psychology
Institution:	Western Sydney University
Title:	Dr
Signature:	A Bliuc
Date:	31/01/2019

Please submit a **signed** and **dated** copy of this license by one of the following three methods:

1. Upload an electronic version on the JoVE submission site
2. Fax the document to +1.866.381.2236
3. Mail the document to JoVE / Attn: JoVE Editorial / 1 Alewife Center #200 / Cambridge, MA 02140

Dear Dr. DSouza,

We have now revised our manuscript, JoVE58851 "Integrating computerized linguistic analysis and social network analysis to capture addiction recovery capital in a virtual community", according to the reviewers' feedback - please see enclosed the revised manuscript (all revisions are tracked) and the Revisions letter where we describe how all of the reviewers' comments were addressed.

We have also included a signed Author Licence Agreement and copyright permission to reuse figures from Bliuc et al. (2017).

Sincerely,

Ana-Maria Bliuc (on behalf of all the authors)

Editorial Comments	Our Response
1. Please take this opportunity to thoroughly proofread the manuscript to ensure that there are no spelling or grammar issues.	The manuscript was proofread and further edited.
2. Please print and sign the attached Author License Agreement - UK. Please then scan and upload the signed ALA with the manuscript files to your Editorial Manager account. As some authors are affiliated with UK institutions, can you please check whether open access is required by your funding agencies.	Please see attached.
3. Please obtain explicit copyright permission to reuse any figures from a previous publication. Explicit permission can be expressed in the form of a letter from the editor or a link to the editorial policy that allows re-prints. Please upload this information as a .doc or .docx file to your Editorial Manager account. The Figure must be cited appropriately in the Figure Legend, i.e. “This figure has been modified from [citation].”	Please see permission attached and appropriate citation of the figure was included in the Figure Legend.
4. Please revise lines 150-152, 160-162, 169-184, 203-205, and 207-209 to avoid previously published text.	All these lines have been now revised.
5. Please note that your protocol will be used to generate the script for the video and must contain everything that you would like shown in the video. Software must have a GUI (graphical user interface) and software steps must be more explicitly explained ('click', 'select', etc.). Please add more specific details (e.g. button clicks for software actions, numerical values for settings, etc.) to your protocol steps. Please provide software screenshots as supplementary files to match each step. Some examples: 6. 1.1.2: Please specify the online community page. Is the weblink pasted somewhere in the function? 7. 1.1.4 and 1.1.5: Should they refer to step 1.1.3 instead of 1.1.2 as ID number is extracted during step 1.1.3? 8. 1.1.6: Please specify the criteria for cleaning and merging data. Are the data extracted in steps 1.1.2-1.1.5 exported somewhere? 9. 2.1: What are retention data? How are they	We have now included more detail for each of the steps and we attach screenshots as supplementary files. Some limitations of the method are described in the discussion, and the References and the other issues have been addressed.

obtained and imported? 10. 3.1.1-3.1.2: These steps are unclear. Please describe how to create different lists. 11. 4.3: Please describe how. 12. 4.4: Please describe how to match with existing textural data. 13. Line 148: Please describe Figure 1 in more detail. For instance, what do different panels show? 14. Table 2: Please explain what the asterisk symbols represent. 15. Discussion: As we are a methods journal, please also discuss critical steps within the protocol, any modifications and troubleshooting of the technique, and any limitations of the technique. 16. References: Please do not abbreviate journal titles. If there are six or more authors, list the first author and then “et al.”. 17. Table of Materials: Please sort the items in alphabetical order according to the name of material/equipment.	
Reviewers' comments:	**Our Response**
Reviewer #1: Manuscript Summary: The article did a wonderful job of explaining the how and why of an innovative method useful in evaluating recovery capital. Major Concerns: N/A	We thank the reviewer for the constructive feedback.
Minor Concerns: Line 39 (and abstract): the information about how the group was established is a bit confusing. I might flip it around to write "the facebook page is a resource for a face-to-face recovery group". - I might also indicate that the group involves members, staff, and community members/other and indicate what "community members" means.	We have integrated the feedback in the revision by changing the wording in the Long Abstract where we now say: “To measure recovery capital development, naturally occurring data was extracted from the Facebook page of a specific recovery program - with the Facebook page being set-up as a resource to support a face-to-face recovery program.” and “Social interaction was measured through the linkages between the online contributors/members of the online community as represented by program clients, staff and supporters from the broader community”.
Line 69: You note traditional self-report measures having biases and inaccuracies - it might be useful to note some examples of what that looks like, and then indicate how this method reduces them.	We have changed that statement as follows: “Firstly, our method overcomes some of the limitations due to the use of self-report measures in addiction research, particularly around recall and self-presentational biases. While self-report measures are

	considered to have reasonable levels of reliability and validity, they are susceptible to biases and inaccuracies. To enhance accuracy and minimize bias, it has been recognized that there is a need to increase the use of novel measures and data collection situations designed to avoid or minimize these issues[8]. By accessing data naturally occurring in contexts where people in various stages of recovery interact spontaneously and by using analysis methods which can extract meaningful information from this data (able to capture indicators of psychological states), biases due to social desirability (self-presentational) and inaccuracies due to limitations in recall can be reduced or even eliminated."
Line 81: A brief sentence or two describing the basics of programming would be helpful to novice users (i.e., An R-package is….)	We now say: " (...)Packages refer to functions, datasets, or compiled code that allow users to analyze, transform, or extract data. In the case of the Rfacebook package, it allows the user to extract data from Facebook into R."
Line 141: "Contributes the recovery" should be "contributes to…"	This has been corrected.
Line 143: should be "…eight months, and predicted…"	This has been corrected.
Line 144: rather than "designed around…" should be "designed for fostering…"	This has been corrected.
Briefly explain what Figure 1 is showing - for those not as familiar with network analysis	We have now added the following explanation of Figure 1: "The figure illustrates the activity in the online community observed each month for a period of 8 months, in the form of connections between all participants in the online community (i.e., commenting on posts, liking posts, and liking comments). The number of connections that an 'agent' in the network has will determine how central they will be in the social network."
Line 172: list: commas should be used rather than semi colons	This has been corrected.
Line 177: range of time in program, small to larger number (i.e., 86-464	This has been corrected

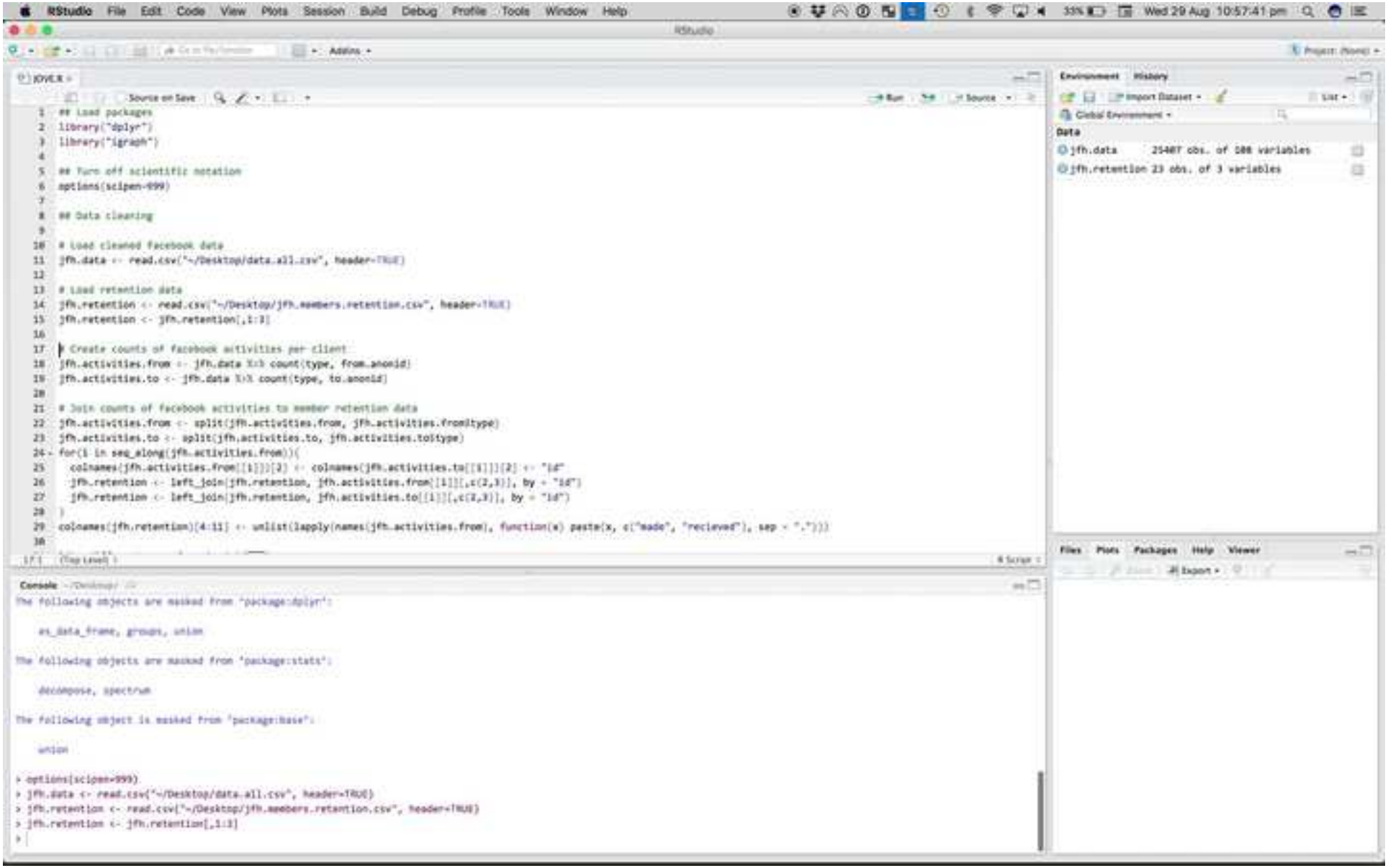
Line 178: remove "as the" in "as the number of likes received	This has been corrected
Line 183: comma after "posts"	This has been corrected
Figure 1: A bit more explanation needed. "movement from periphery to center, indicating…."	We now say: "Visualizations of the online social networks and their evolution over time can provide valuable information on the movement of members of the online community from the periphery to the center of the network and vice-versa (these movements in the network indicate changes in levels of engagement with the online community)."
Line 201: remove "upon" from "impact upon retention…"	This has been corrected.
Line 212-214: This I very confusing. Do you mean the study described in this article? Above what method? Where was the retention data from? The face-to-face program? More information is needed here.	We changed the order of the paragraphs in the Discussion, so we present more specific explanations of the use of the method before this paragraph (see comment below) - the meaning of this paragraph should now be clear.
Lines 233-237: some commas are needed in that sentence, and perhaps break the sentence up into more than one sentence. Perhaps that final paragraph (lines 230-240) could be moved closer to the beginning of the discussion, as it explains how/why the method was used most fully.	We have moved this paragraph in the Discussion section (so this is now the second paragraph in the Discussion).
Reviewer #2: Manuscript Summary: This manuscript describes in more detail the methods that were used to produce findings for a study of recovery capital built through online communities (outcomes already published in another journal). It is quite an interesting method (although really it is a series of methods and analyses) and I could see it being especially useful to those working with health behaviors and online communities, as well as for those interested in doing this sort of data collection.	We thank the reviewer for the constructive feedback.
Overall, I like that the authors have spent time going into more detail for readers the methods used (than could be provided with the published report), but I found myself wondering at the aim of the article. The text starting on line 79 (under protocol) looks like step-by-step instructions for the analysis, but I was not sure whether this article is meant to be a tutorial or something else. That is, if a tutorial, I would find that more specific step-by-step instructions, rationale and output would be	We have now added significant additional information for each of the steps of the protocol, so the resulting video will provide enough information to make the method reproducible and applicable to other research. Perhaps the fact that the protocol and accompanying materials are to be used to create the script for the video article (a method paper) has not been clearly conveyed. However, the aims should be clear in the finalised iteration of the article.

useful. As a tutorial there is far too little information. If not a tutorial, then I am not sure of the authors' aims because the collection of data from a social media site such as facebook is not necessarily an innovative approach as it is gaining traction among many fields of health behaviors. I struggle to make direct suggestions because the aim of the article is still not clear to me, although I think it could be useful with a clearer aim, framing, and different organization.	
Minor issue: Should something about institutional approval be stated/included here? (I would be curious to know if there were institutional review board issues with collecting this kind of data, especially given all the privacy issues social media sites like Facebook have come up against more recently!)	We have added a discussion of ethical issues in the Discussion where we now say: "In effect, the method can be applied to any online community where data in the form of connections between members (as social network linkages) and linguistic content can be extracted. However, in accessing and working with online data, researchers need to be aware of ethical issues, some which are applicable to self-report and other types of data more generally, and some which may only be encountered in the online environment. In the research described here, consent was obtained from the organization managing the recovery program and strict measures were taken to ensure the complete anonymity of the participants in the open Facebook page (e.g., after online and retention data matching, all identifying information was removed from the files and also no potentially self-identifying quotes were used from the publicly accessible online communication). Close communication with the organization also ensured that the participants in the program were aware of the study and the research findings, and the research team met with members of the recovery community on a number of occasions to discuss the study. In other cases, however, where online communities are not associated with specific offline programs, it might be harder to determine the entity who should be asked for consent for the data extraction (this would apply especially in unmoderated forums where people in recovery seek online peer support). While the general principles of ethical research would apply, researchers need to adopt a case-by-case approach to ensure that the extraction and analysis of online data does not pose any significant risks to the participants (e.g., compromising their privacy)."
Reviewer #3: Manuscript Summary: The paper presents interesting analytic methods and findings related to social support groups on	We thank the reviewer for the constructive feedback.

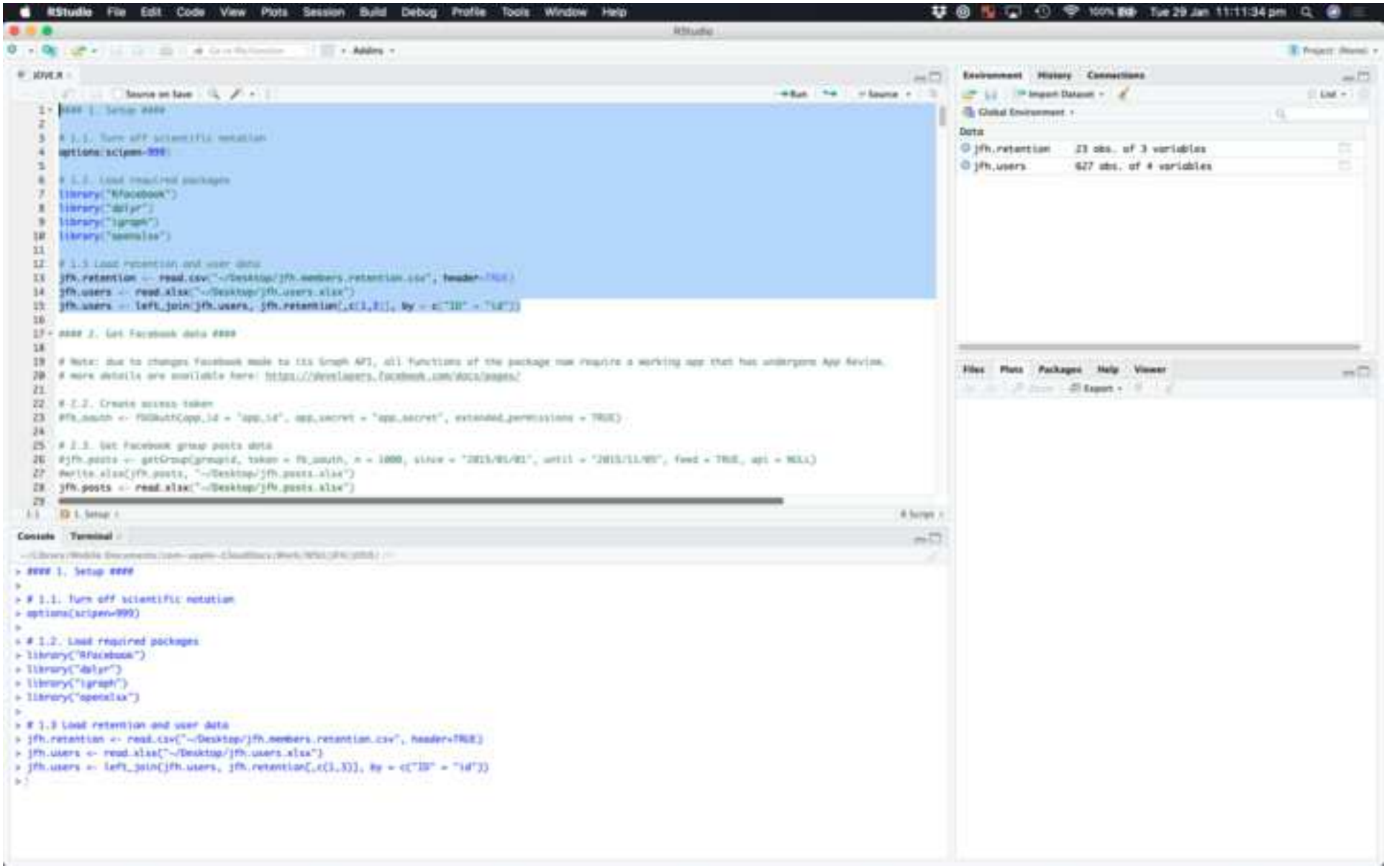
social media and their role on fostering support for addiction problems. However, the current version of the manuscript doesn't fully describe data collection procedures and ethical standards that were practiced during this research on vulnerable populations.	See response to Reviewer #2 for more detailed feedback
Major Concerns: My concern lies on the ethical process of data mining especially regarding the Facebook group you selected for social network analysis. You mentioned data were mined a Facebook group. Data from Face Pages are open to the public, but some Facebook Groups are set for "closed" or "secret" settings. The group participants share their issues with an expectation that the Group(s) is "closed" thus their communications won't be used for other purposes or visible to outside people (non-members). I wonder if authors reached the group admin's prior to mining the data or received permission from the Group members in terms of using their communication data for the study. There was no information how the IRB reviewed the protocol.	We agree with the reviewer in regards with the importance of following strict ethical guidelines in conducting this type of research. The particular Facebook page we used was open and we obtained approval to conduct the research from the organization running the recovery program (prior to receiving ethics approval from the university). A discussion of potential ethical concerns was now included in the "Discussion" section. We now say (see also response to Reviewer 2): "However, in accessing and working with online data, researchers need to be aware of ethical issues, some which are applicable to self-report and other types of data more generally, and some which may only be encountered in the online environment. In the research described here, consent was obtained from the organization managing the recovery program and strict measures were taken to ensure the complete anonymity of the participants in the open Facebook page (e.g., after online and retention data matching, all identifying information was removed from the files and also no potentially self-identifying quotes were used from the publicly accessible online communication). Close communication with the organization also ensured that the participants in the program were aware of the study and the research findings, and the research team met with members of the recovery community on a number of occasions to discuss the study.. In other cases, however, where online communities are not associated with specific offline programs, it might be harder to determine the entity who should be asked for consent for the data extraction (this would apply especially in unmoderated forums where people in recovery seek online peer support). While the general principles of ethical research would apply, researchers need to adopt a case-by-case approach to ensure that the extraction and analysis of online data does not pose any significant risks to the participants (e.g., compromising their privacy)."
It's not clear if you used data from Face Pages or Facebook Groups because you mentioned "Facebook group page" (e.g., on page 1 of 6 -the protocol section; Line 80). These two platforms have different privacy settings, which can affect	We have specified that we refer to Facebook – we now say: "(...) **i.e., the Facebook page of an addiction recovery community)**"

study designs. Will need clarification.	
Minor Concerns: Figure 1.1 ~ 1.8 present social network analysis maps, but to fully understand each figure authors should provide more information on the features and scientific interpretation of each sub-figure in Figure 1. Also, you used the term "clients" - how "clients' different from "members"?	We have included more detail on what Figure 1 represents (also in response to Reviewer 1). We now say in the text: "The figure illustrates the activity in the online community observed each month for a period of 8 months, in the form of connections between all participants in the online community (i.e., commenting on posts, liking posts, and liking comments). The number of connections that an 'agent' in the network has will determine how central they will be in the social network." In the Figure 1 legend we now specify: "**Figure 1.** Monthly representations of the social network of the online community over 8 months suggest changes in the pattern of social interactions between the participants. Different types of participants in the online community are represented with different colors: red indicates clients (participants who are part of the offline recovery program), blue, staff members of the recovery program, and green, members of the broader community who are supportive of the clients (family, friends, pro-recovery advocates, etc.). This figure has been adapted from Bliuc, Best, Iqbal & Upton (2017)."

Click here to access/download;Supplemental File (Figures, Permissions, etc.);screenshots_JOVE1.jpg

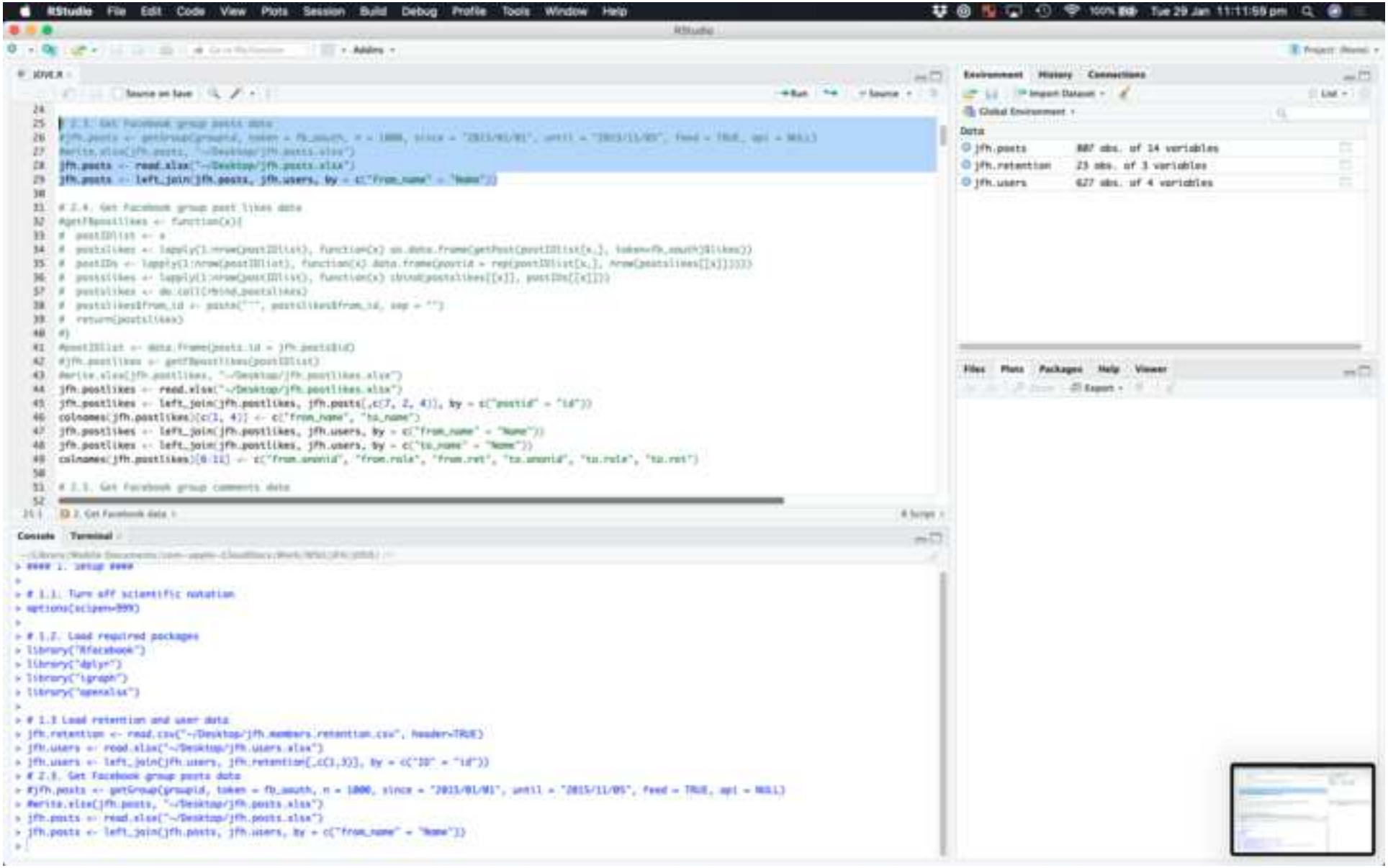


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);1.png

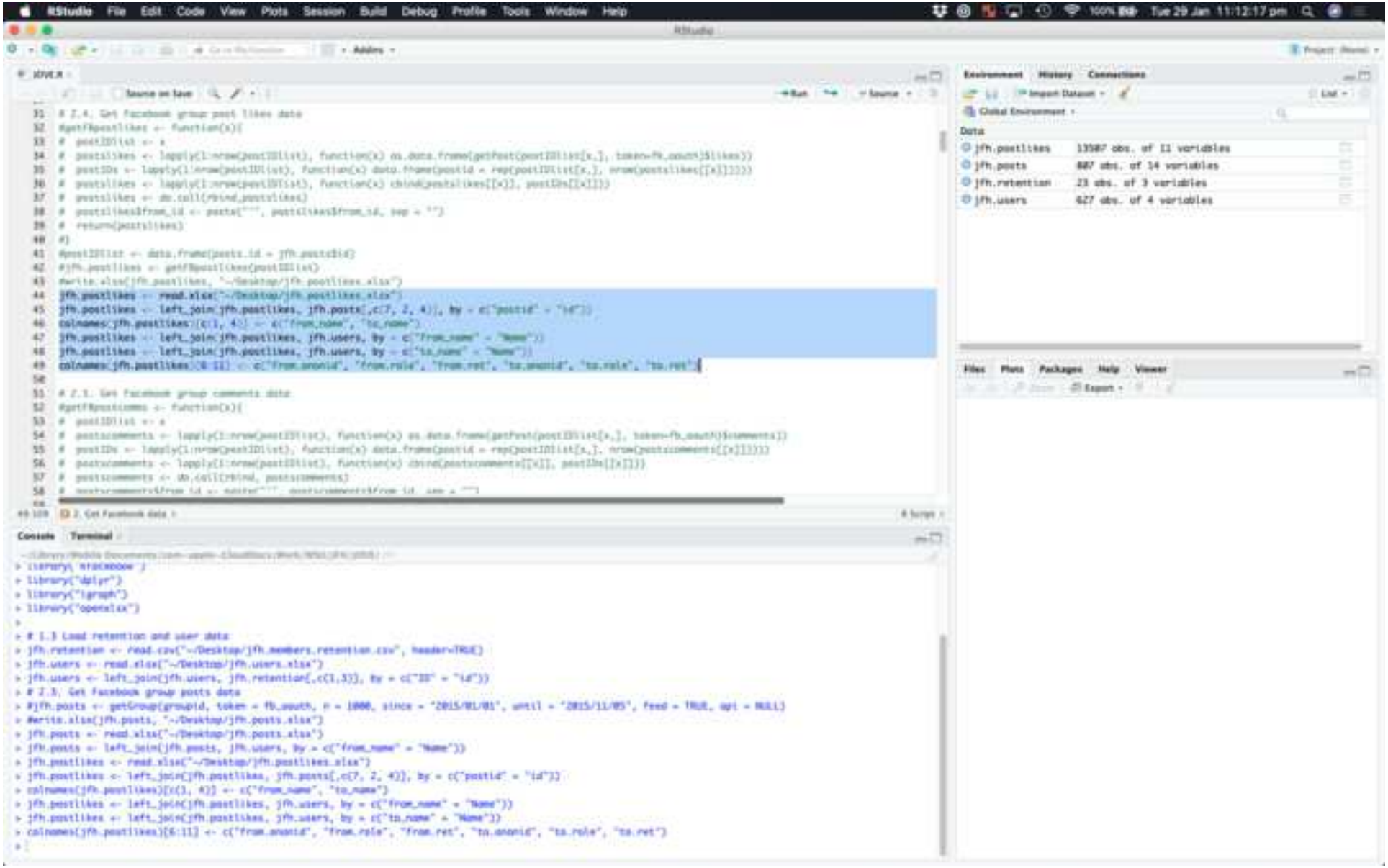


Supplemental File (Figures, Permissions, etc.)

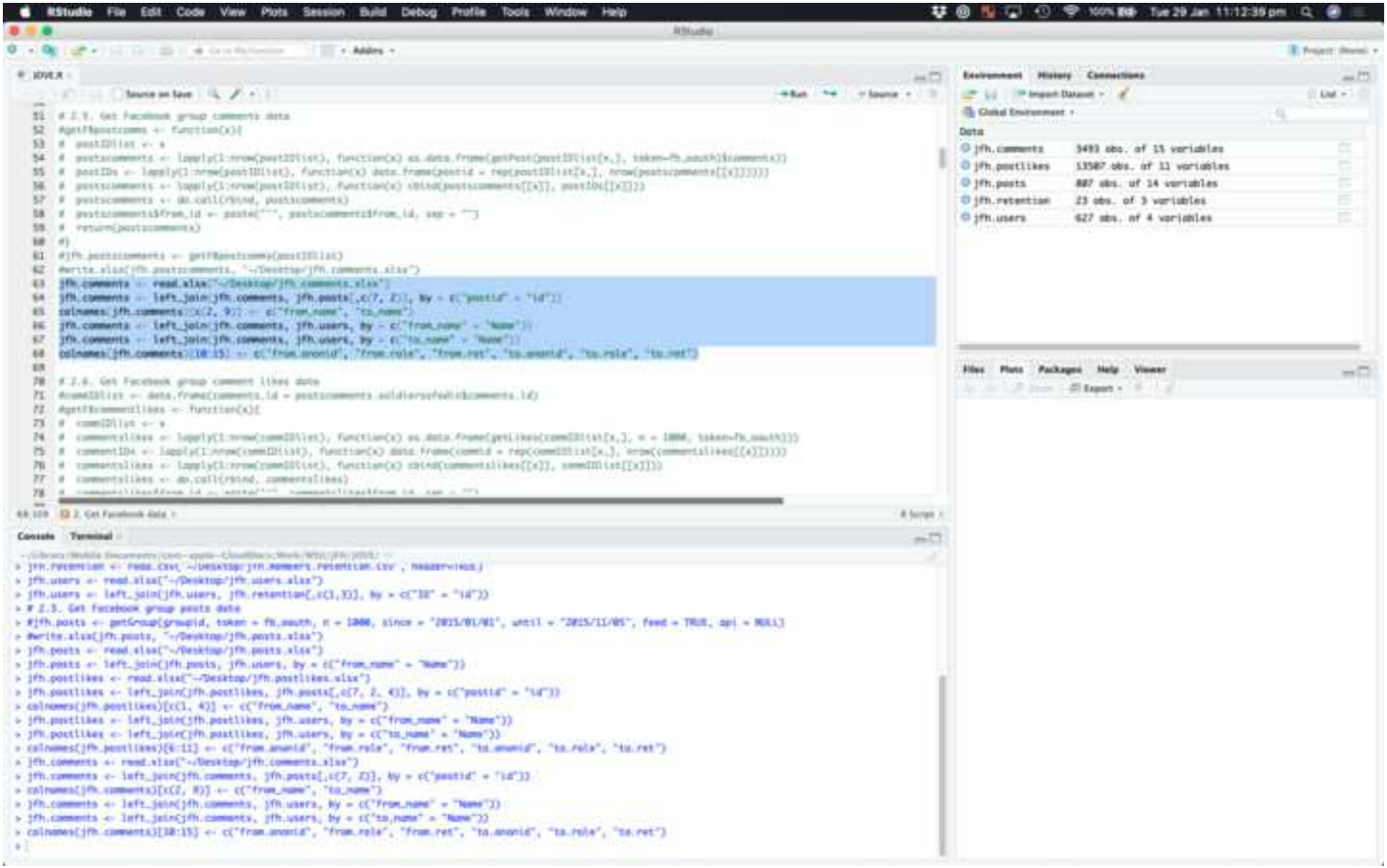
Click here to access/download;Supplemental File (Figures, Permissions, etc.);2.3.png



Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);2.4.png

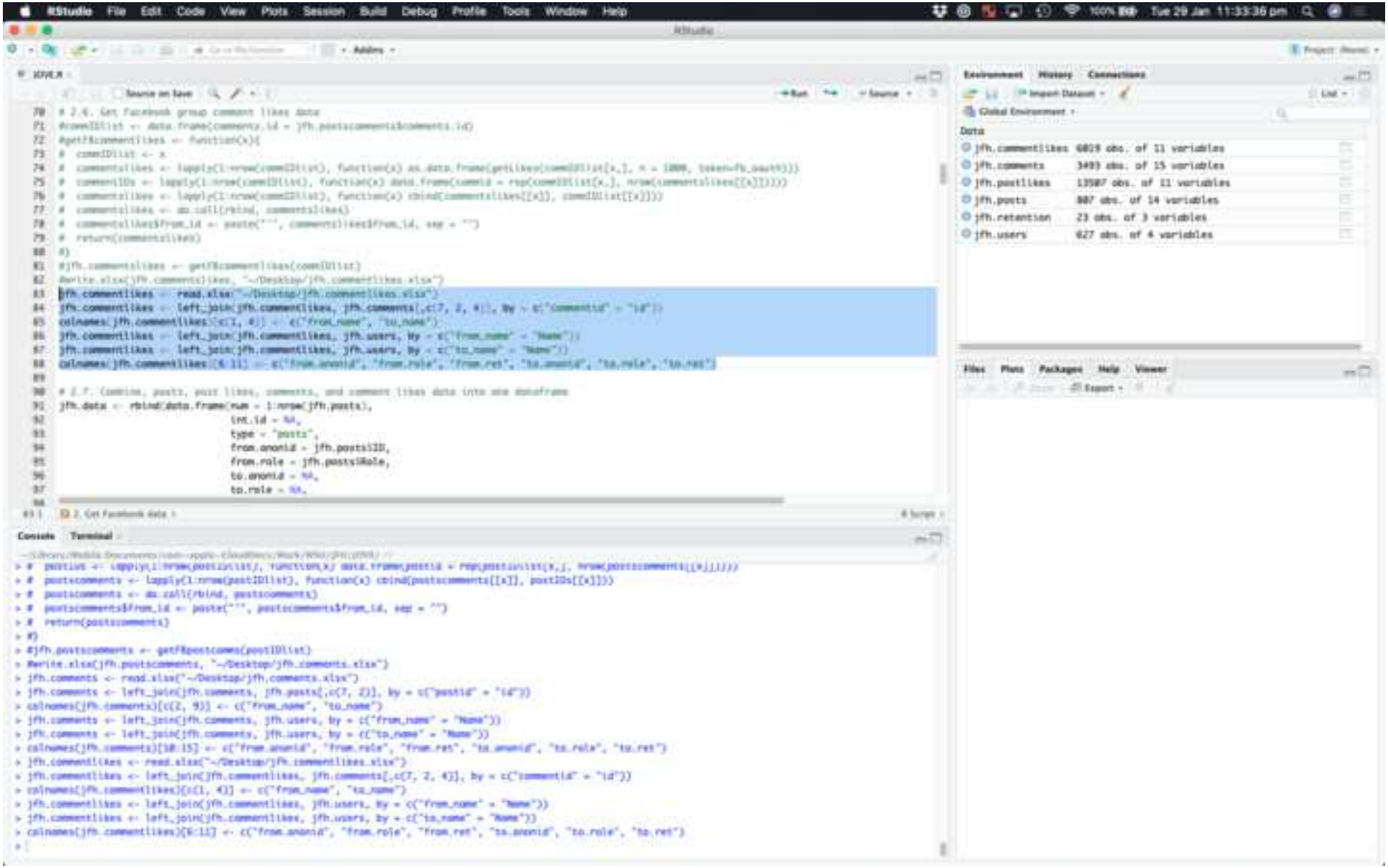


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);2.5.png

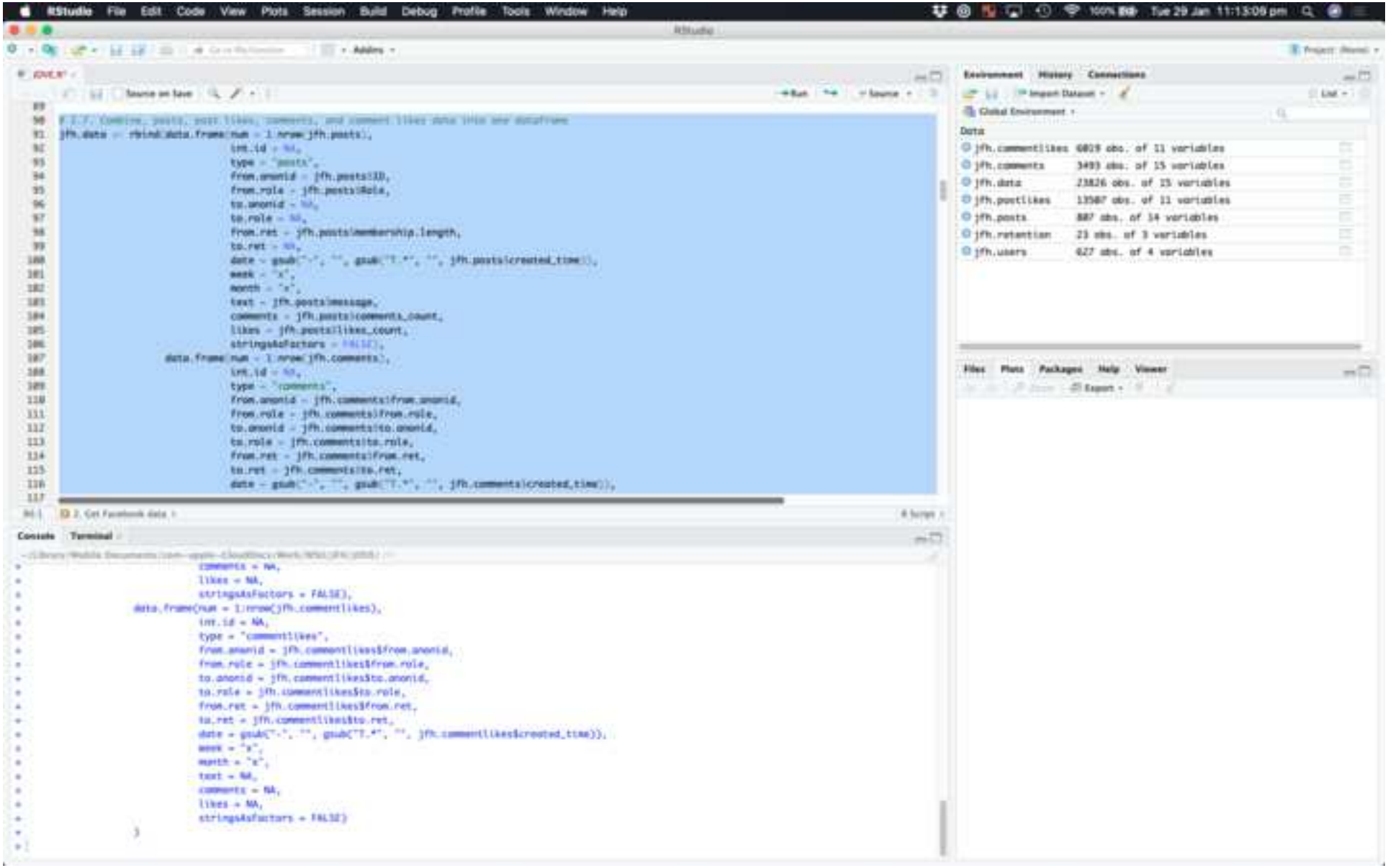


Supplemental File (Figures, Permissions, etc.)

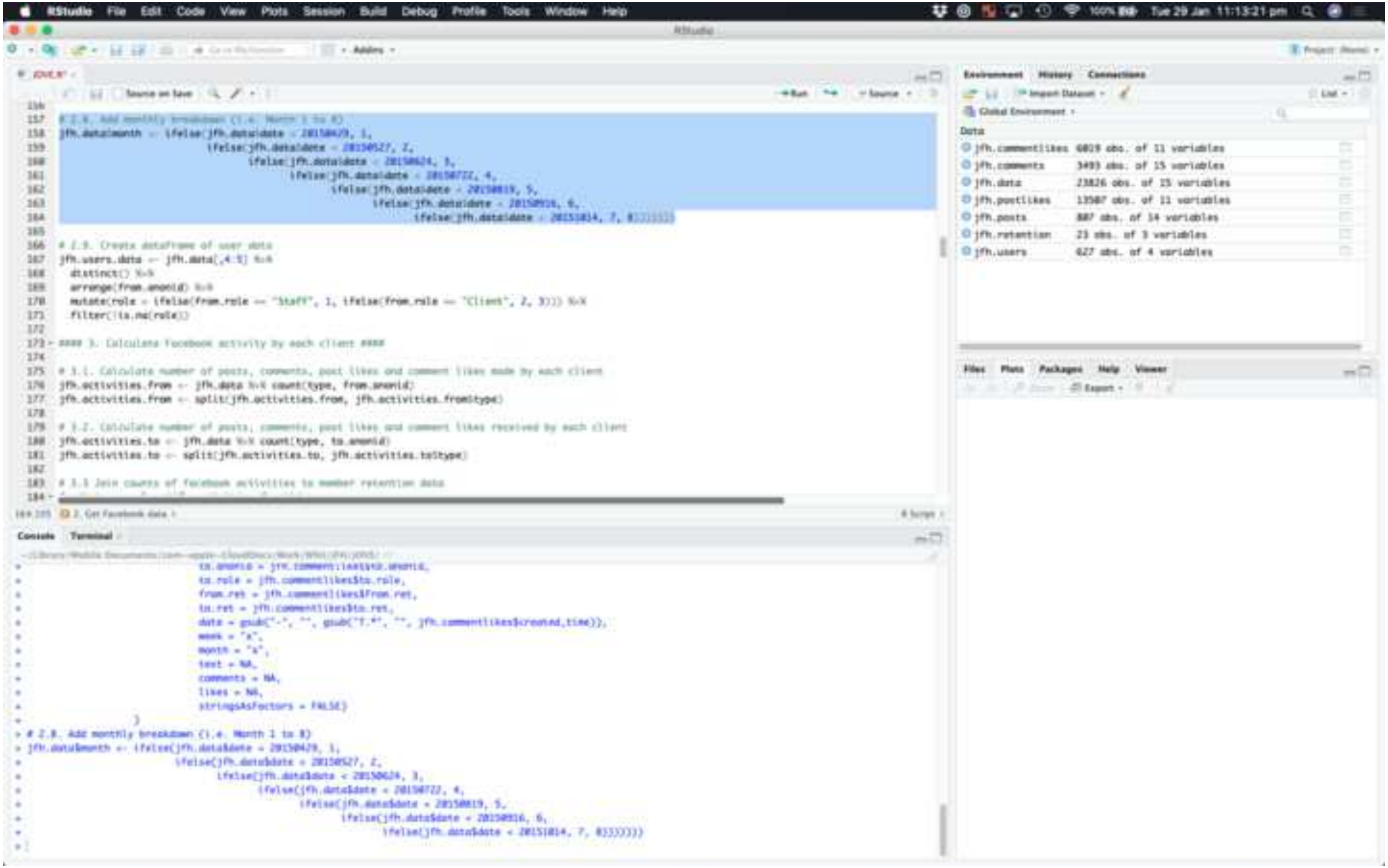
Click here to access/download;Supplemental File (Figures, Permissions, etc.);2.6.png



Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);2.7.png

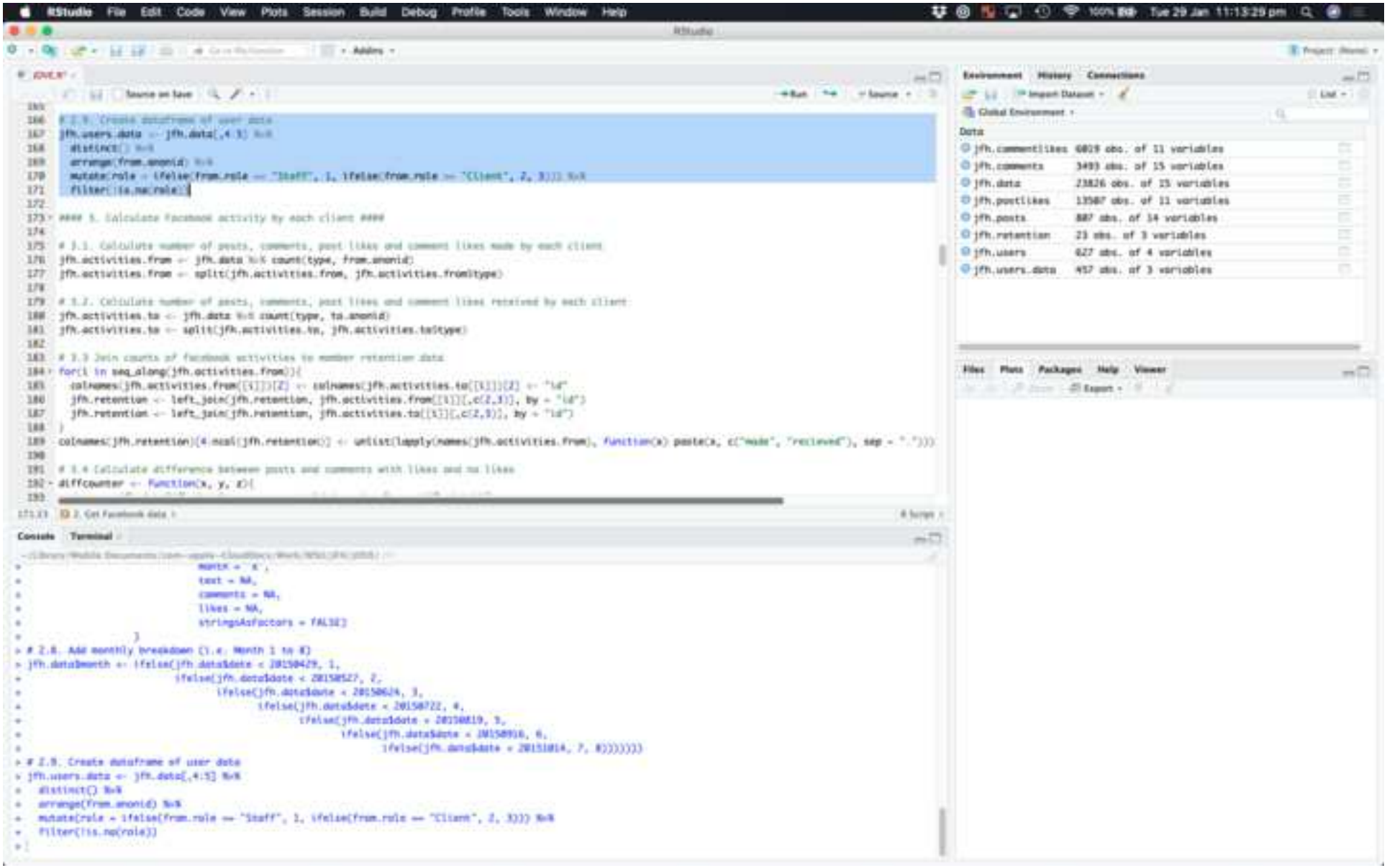


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);2.8.png

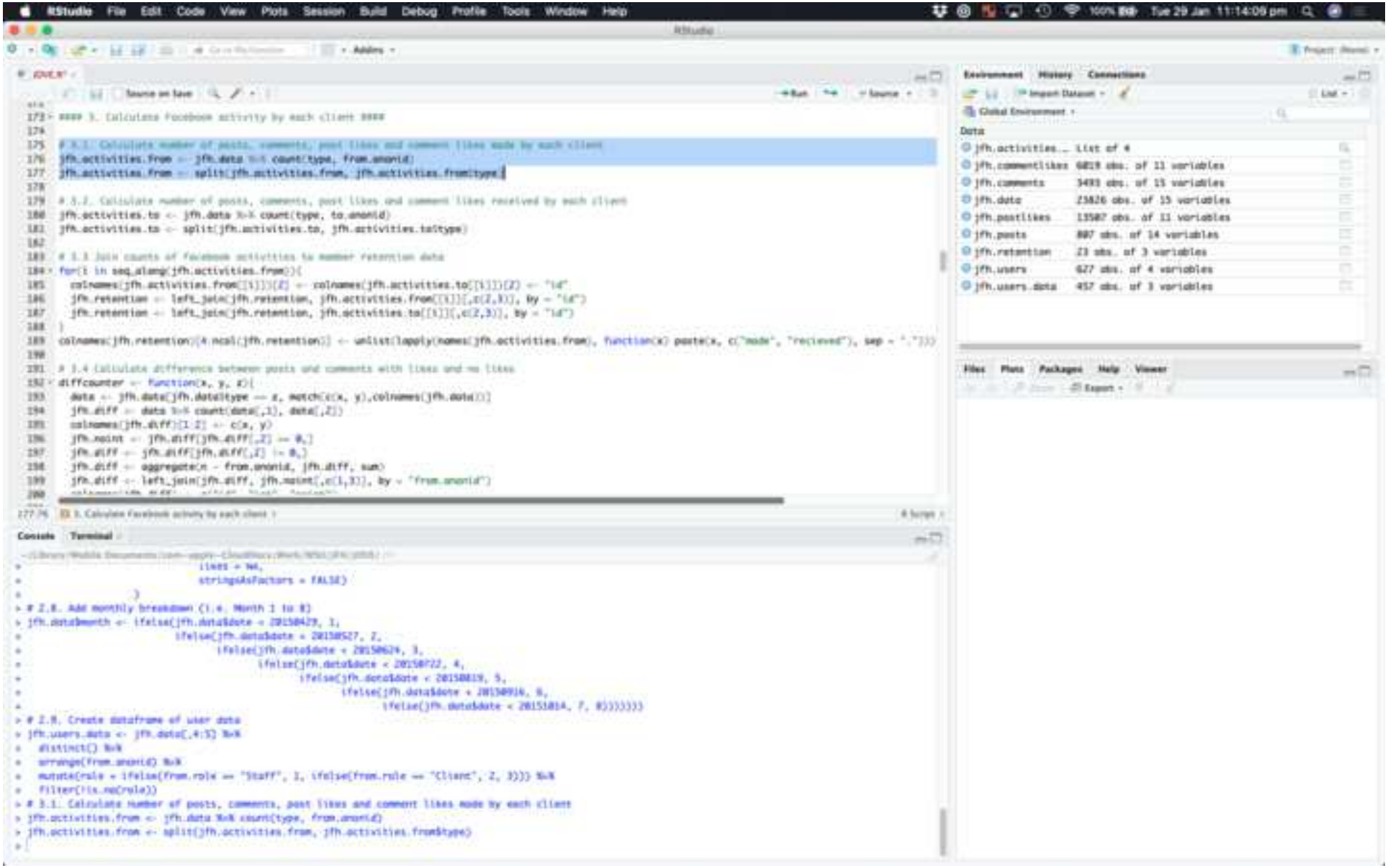


Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);2.9.png

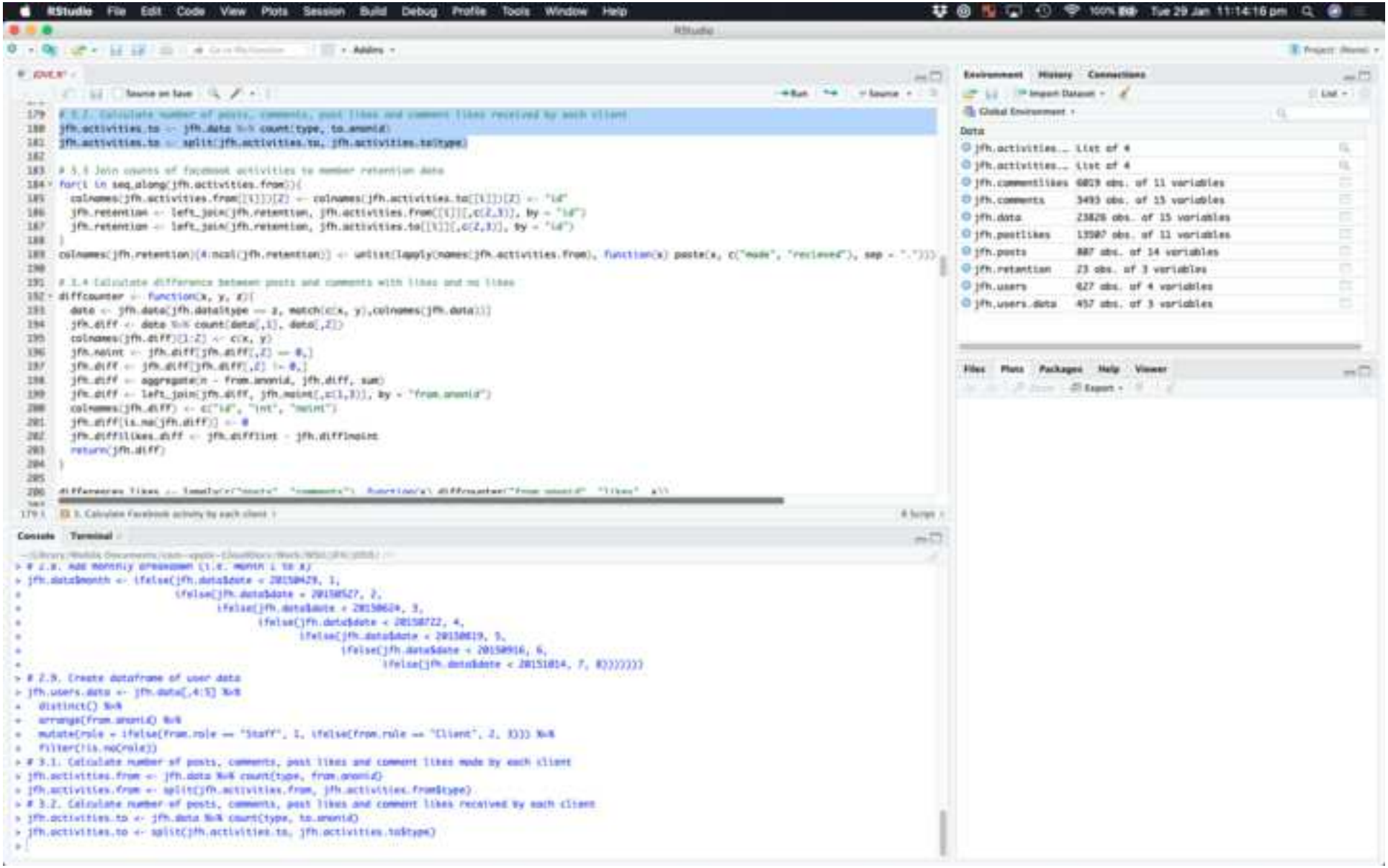


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.1.png

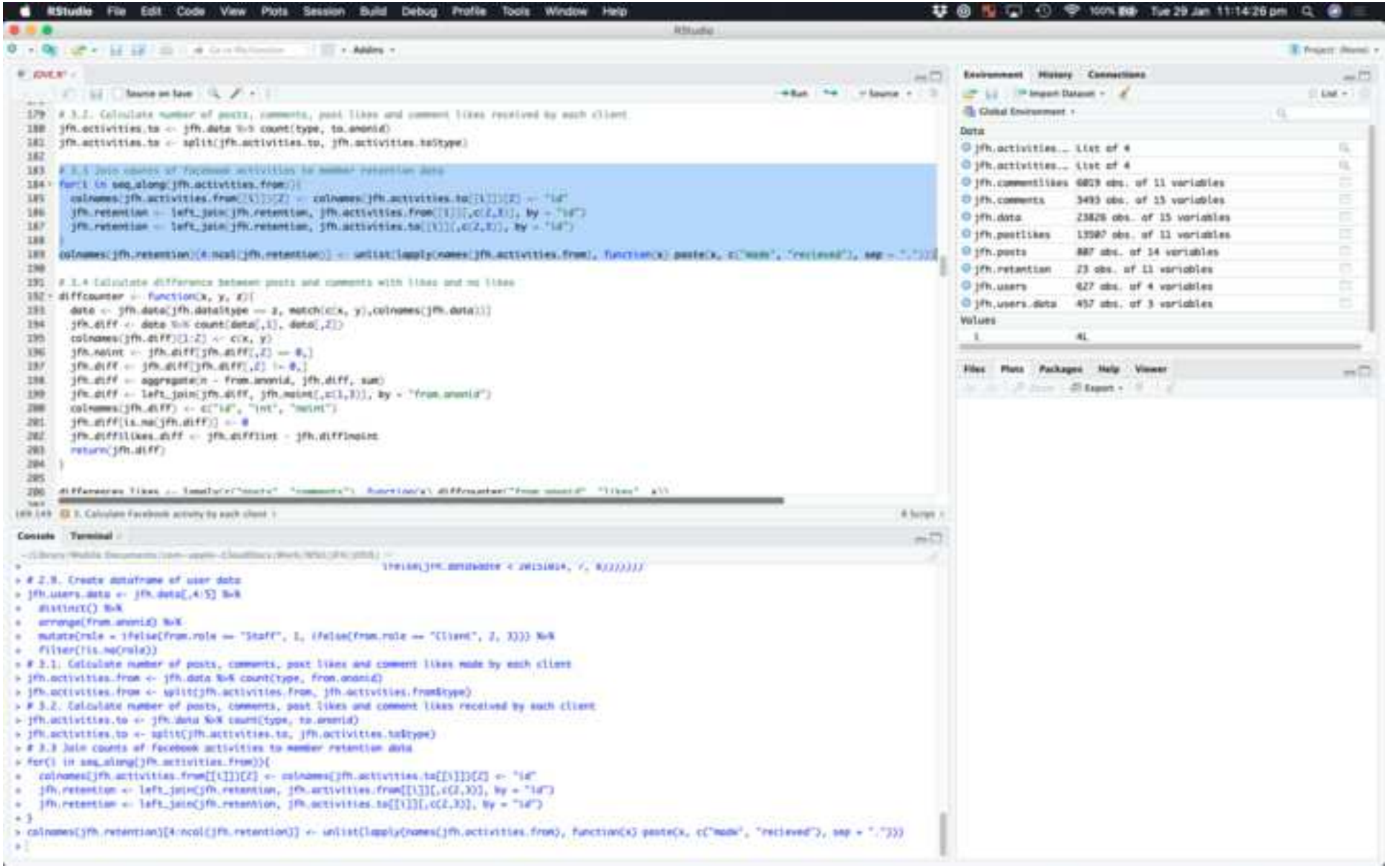


Supplemental File (Figures, Permissions, etc.)

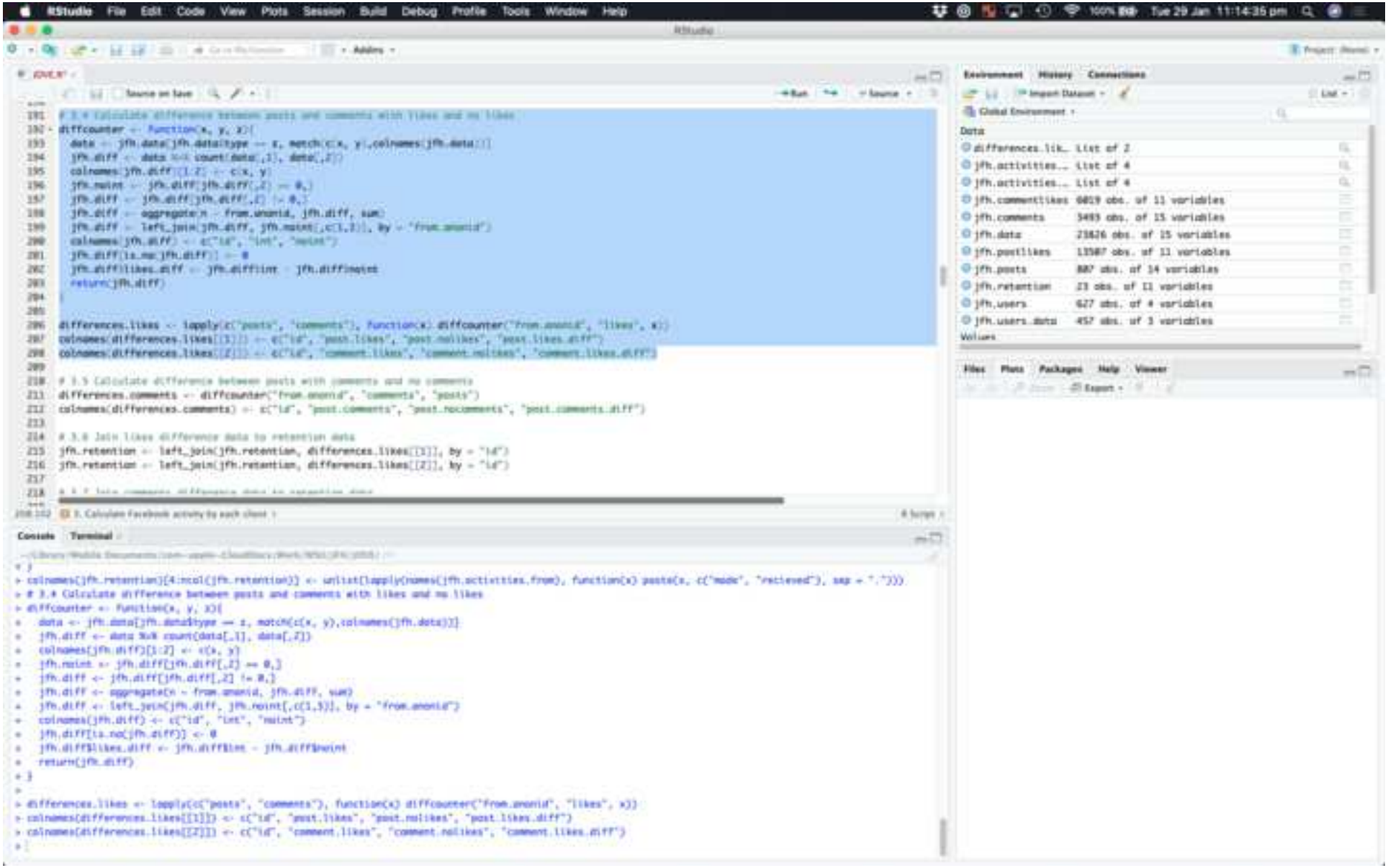
Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.2.png



Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.3.png

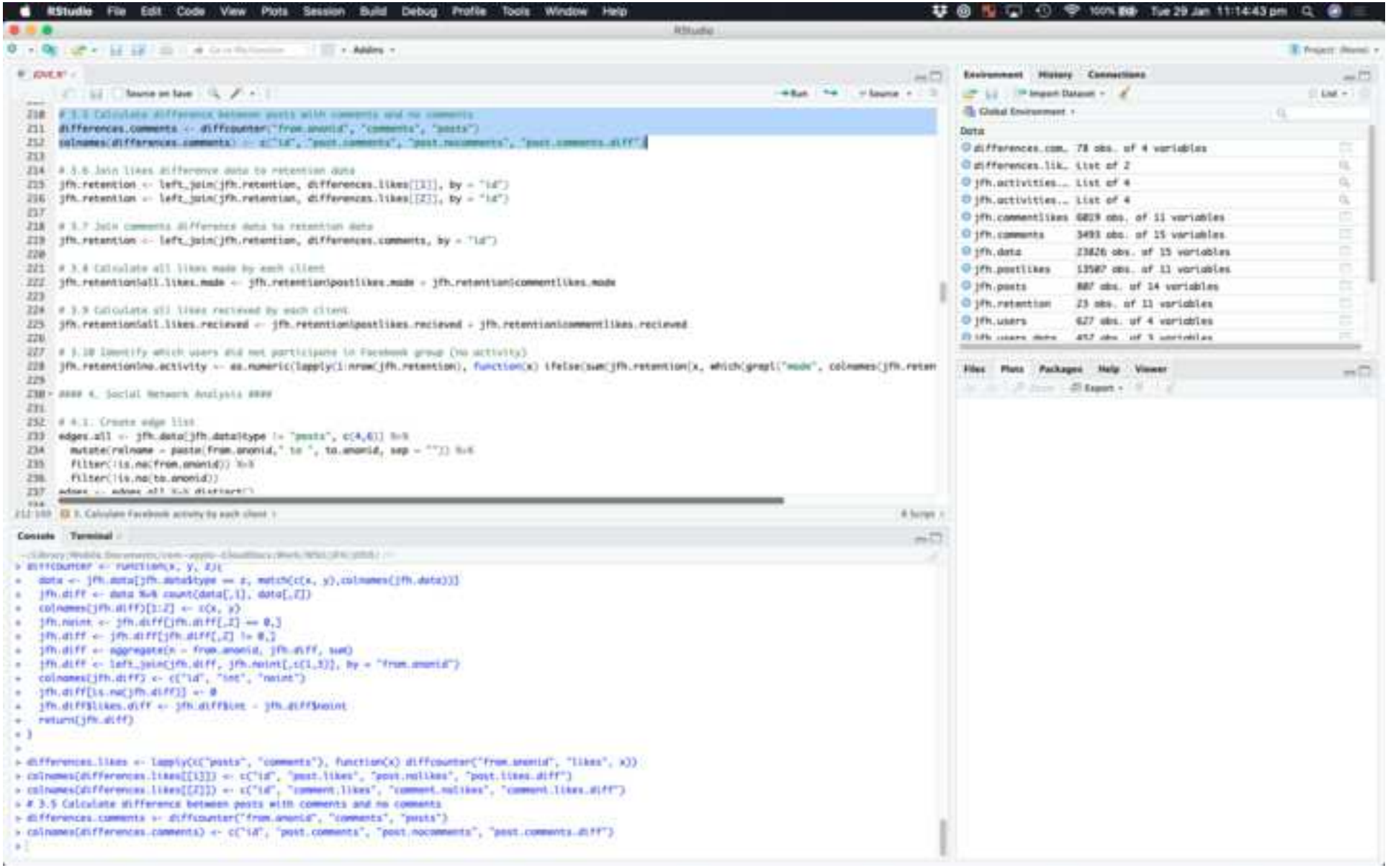


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.4.png



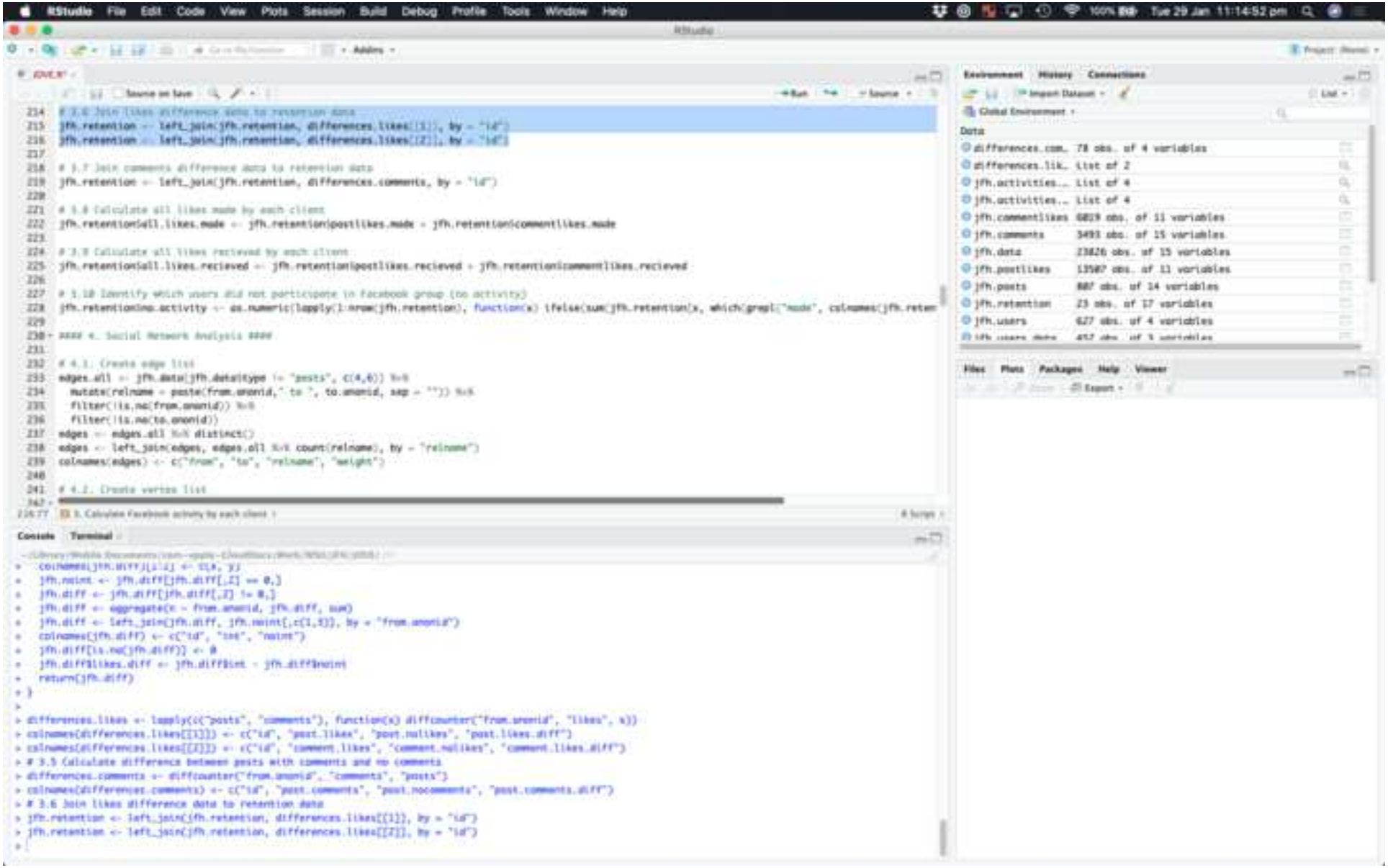
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.5.png



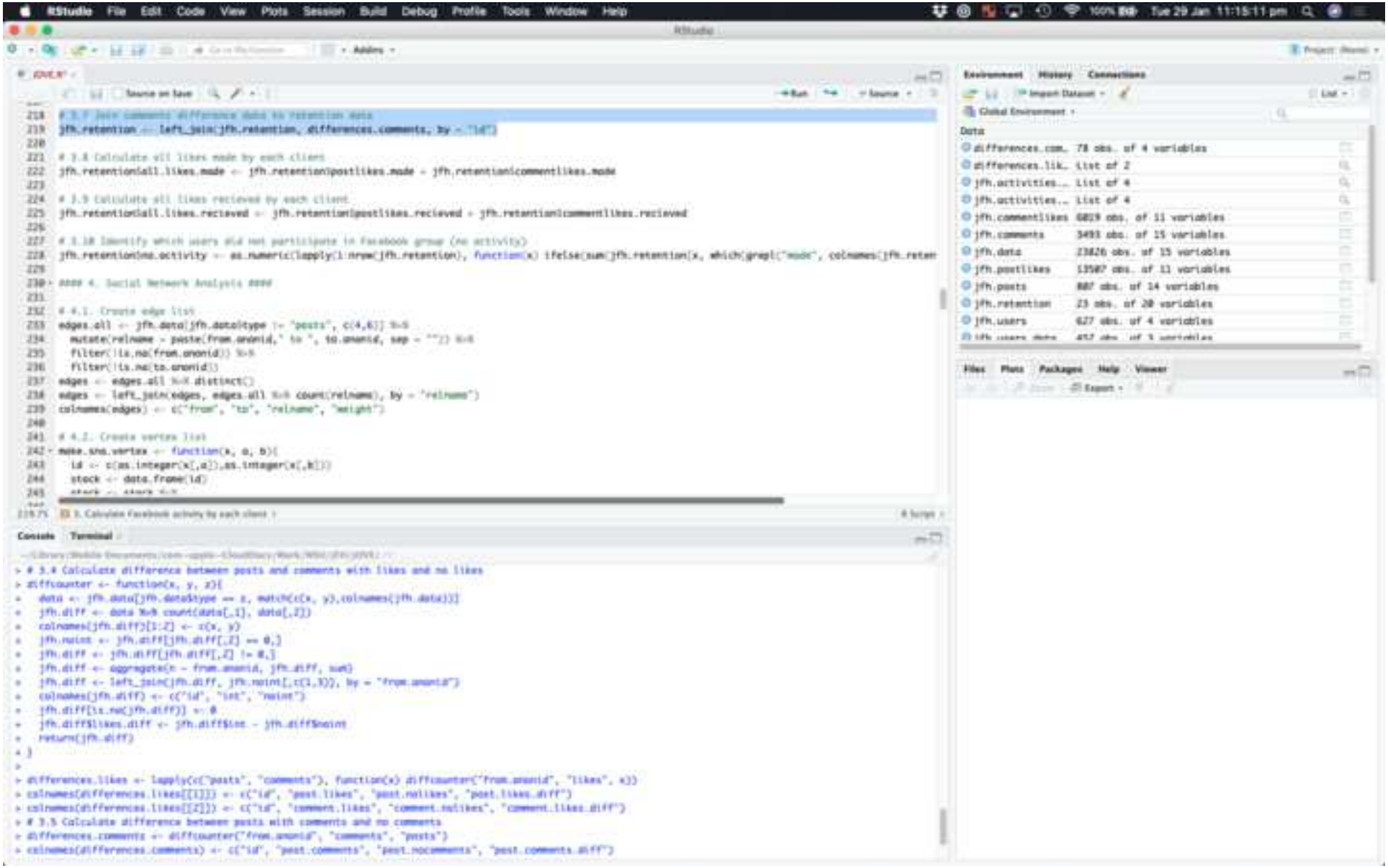
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.6.png



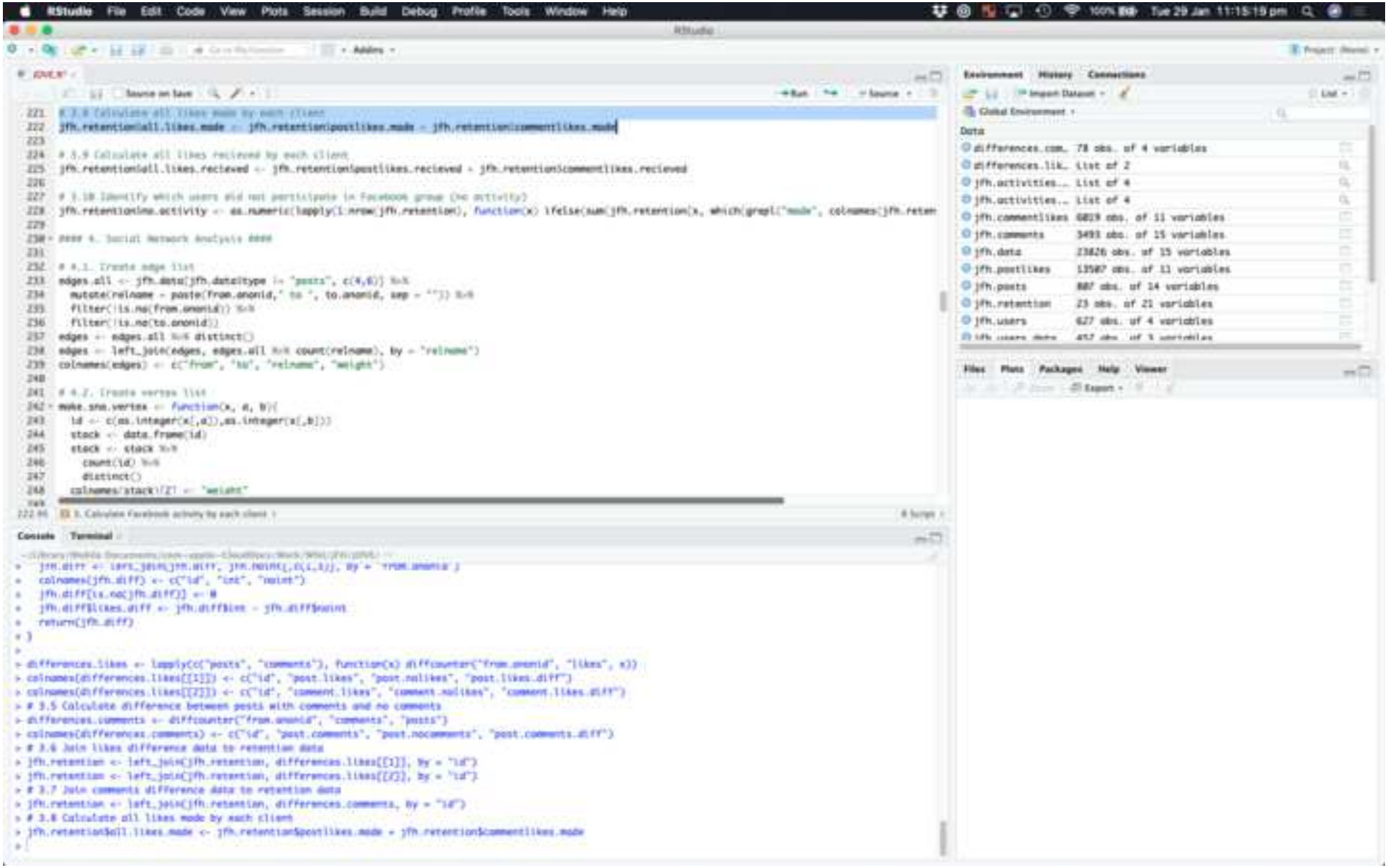
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.7.png



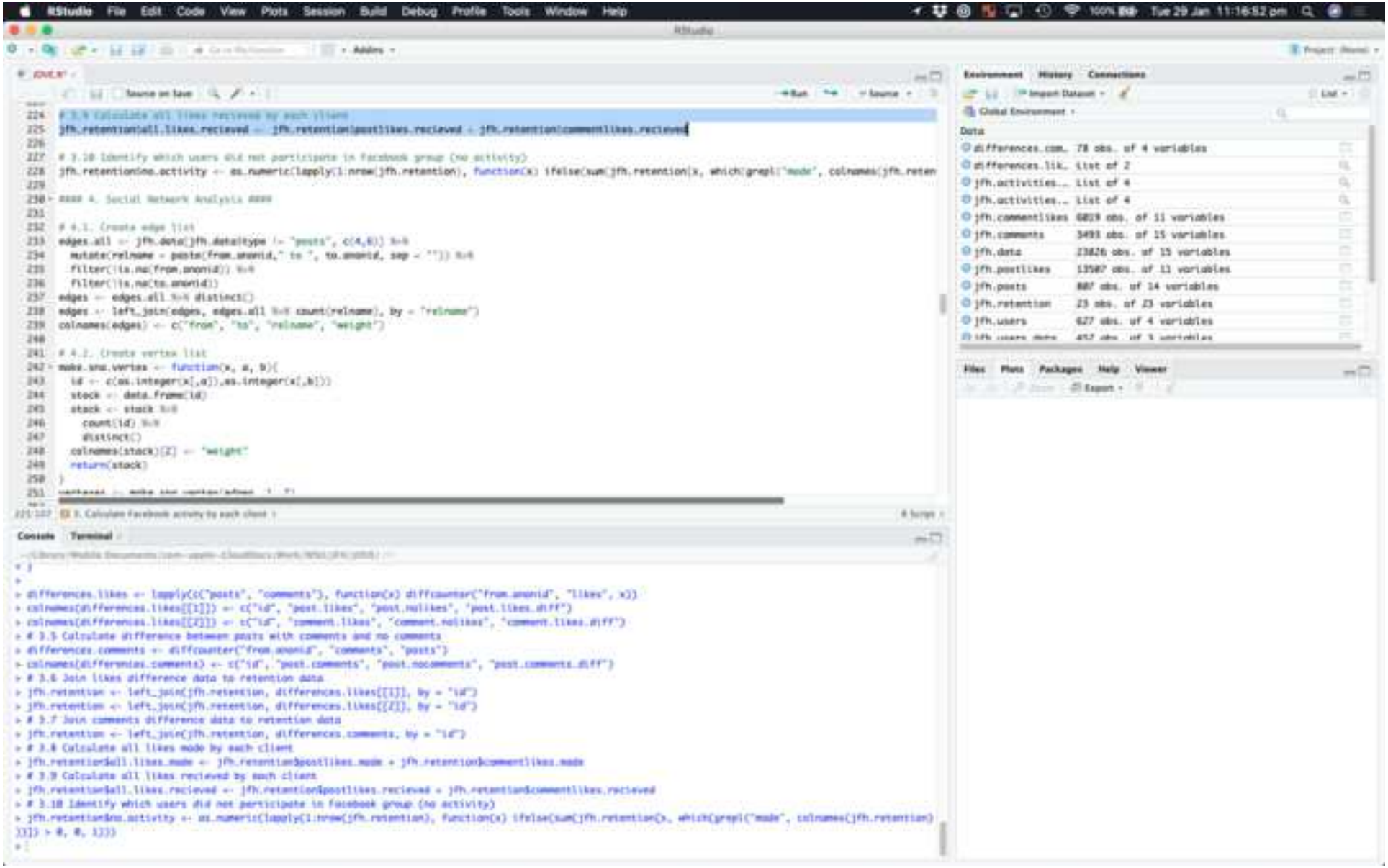
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.8.png



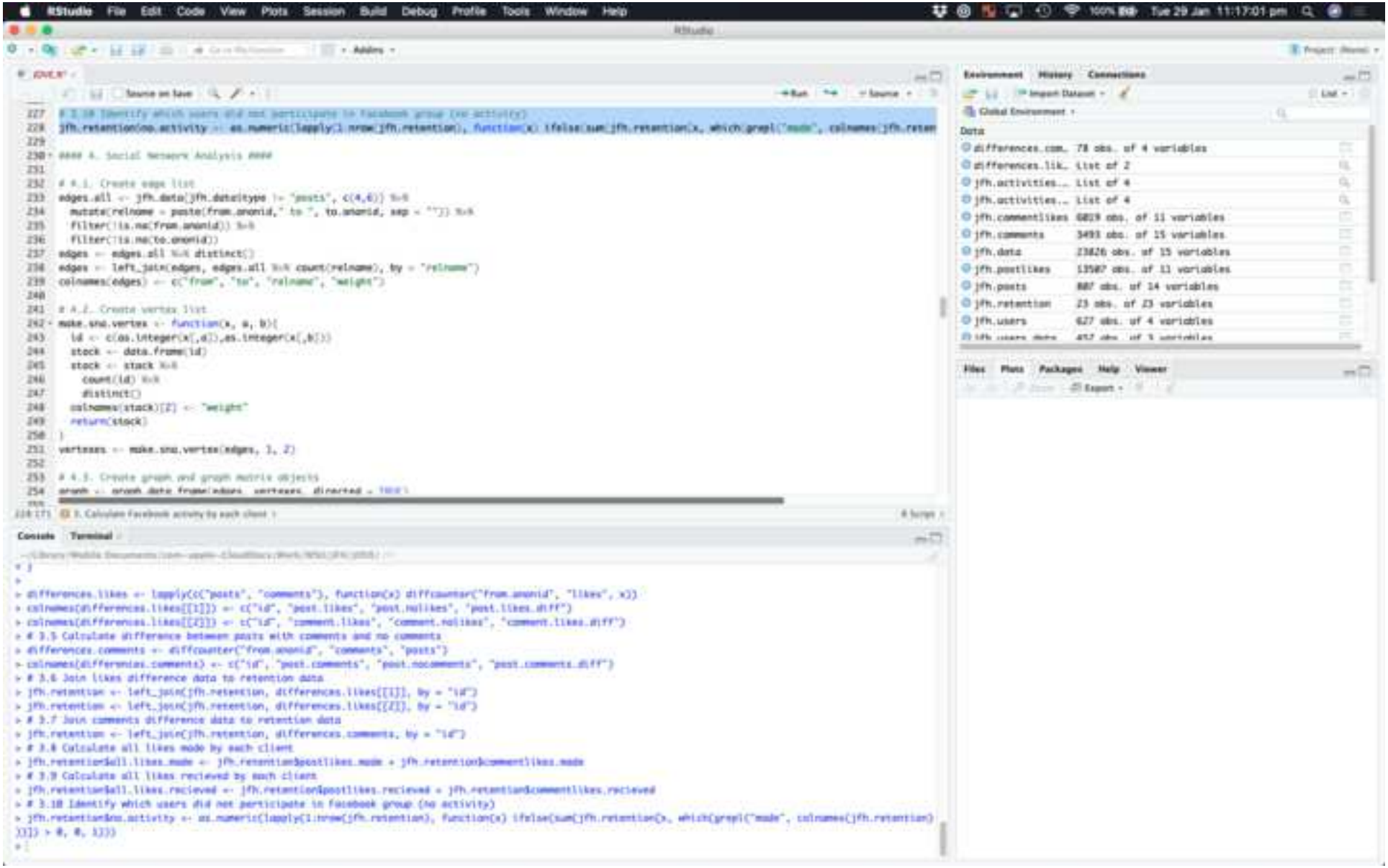
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.9.png



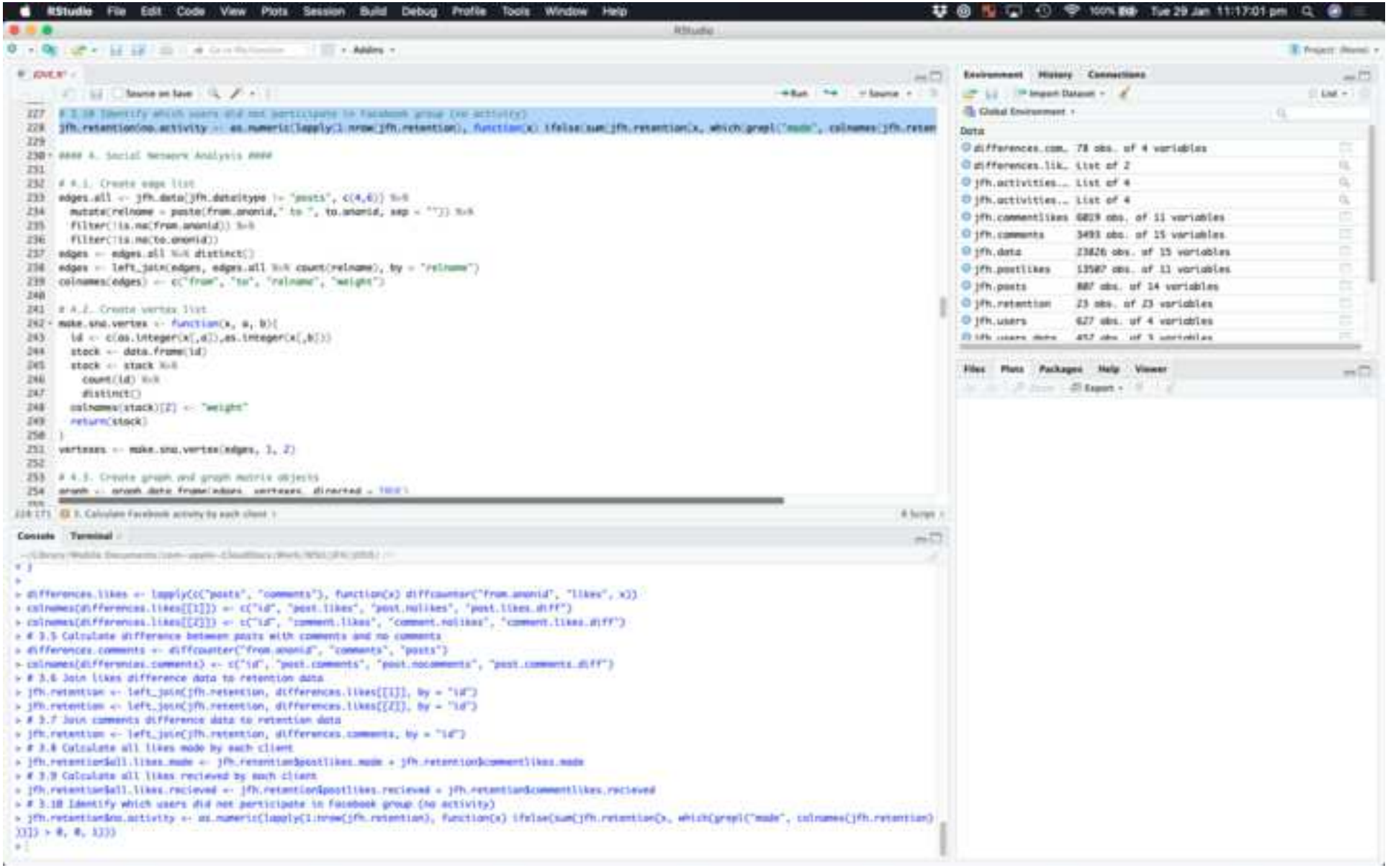
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.10.png



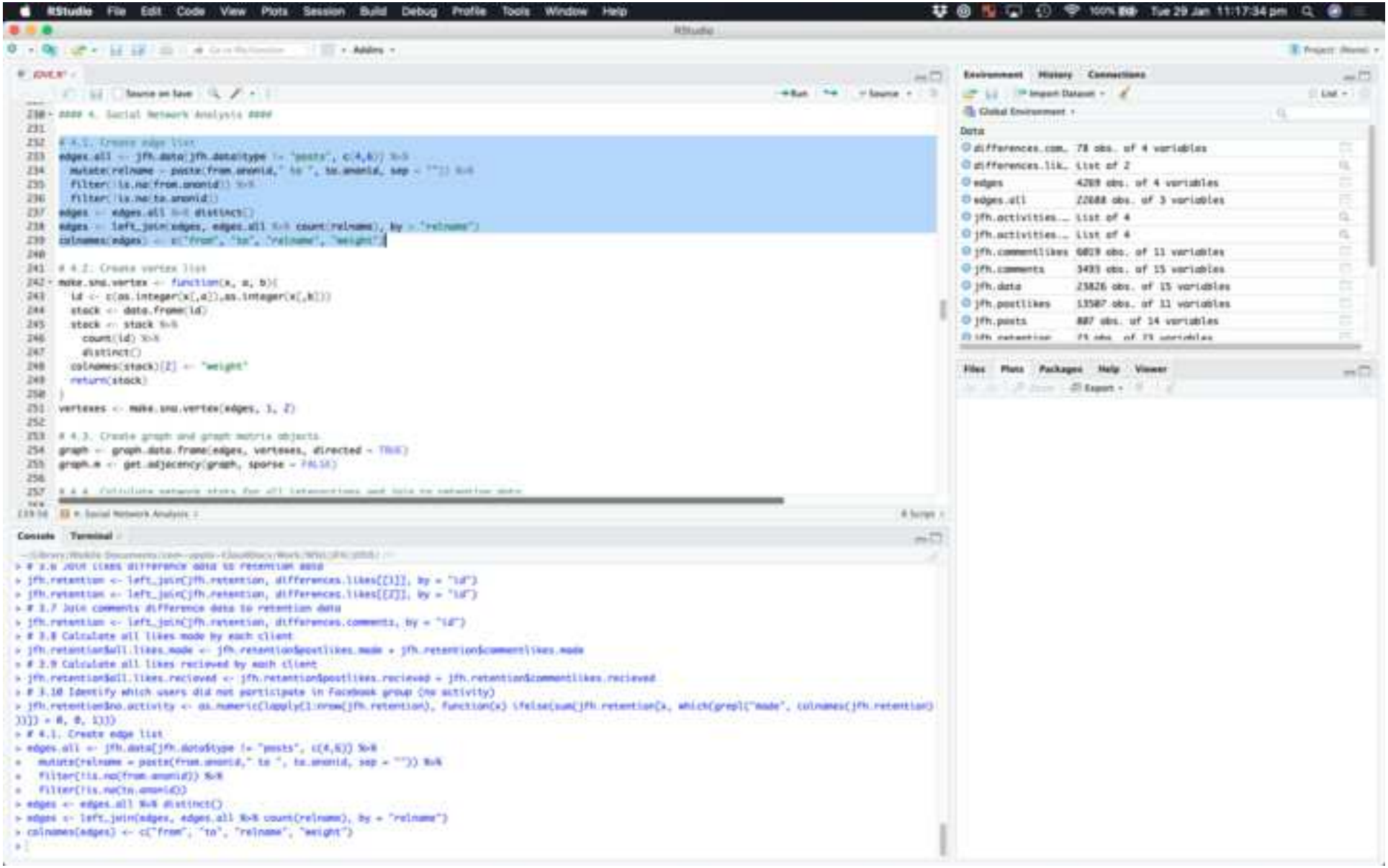
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);3.10.png

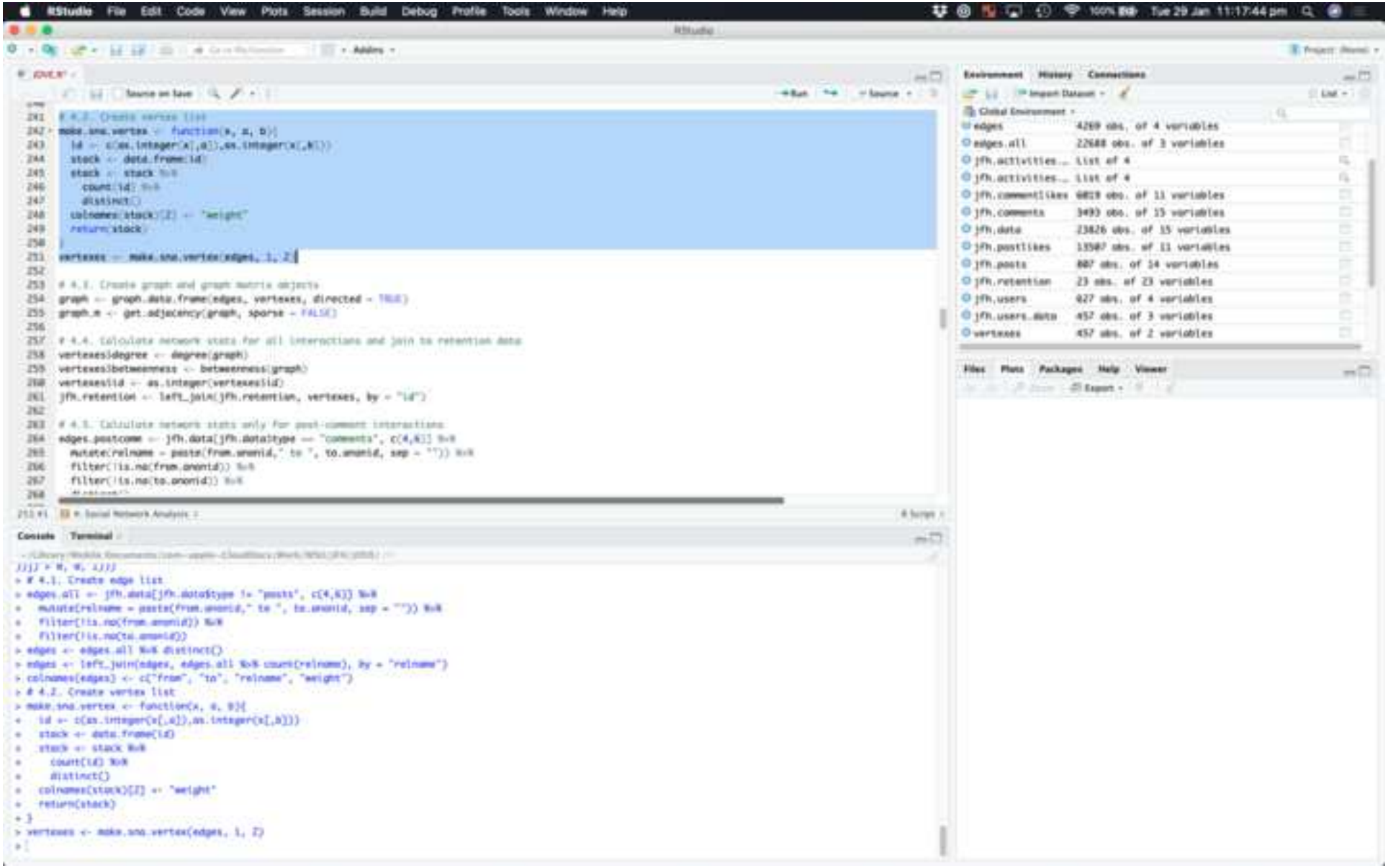


Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);4.1.png

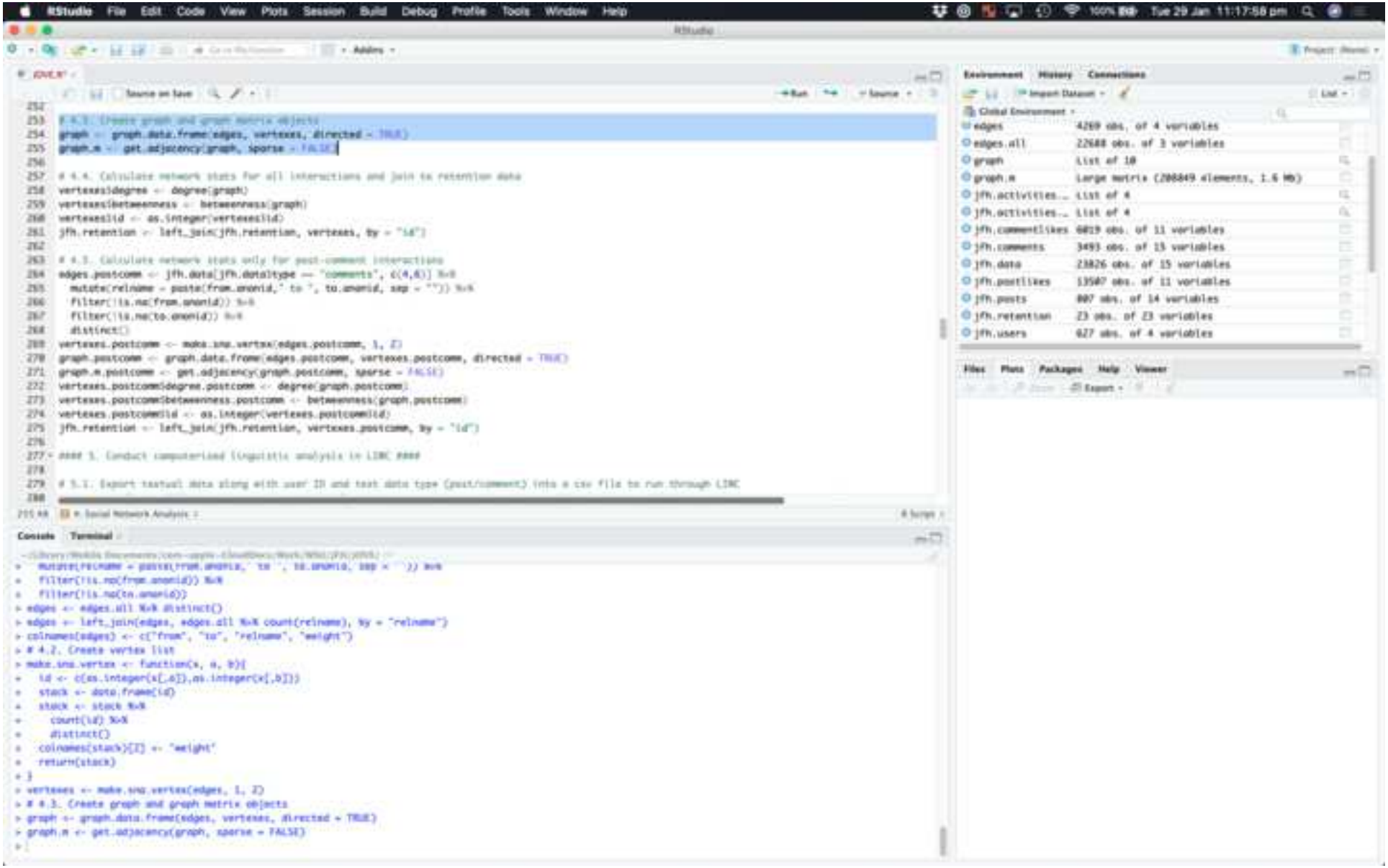


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);4.2.png



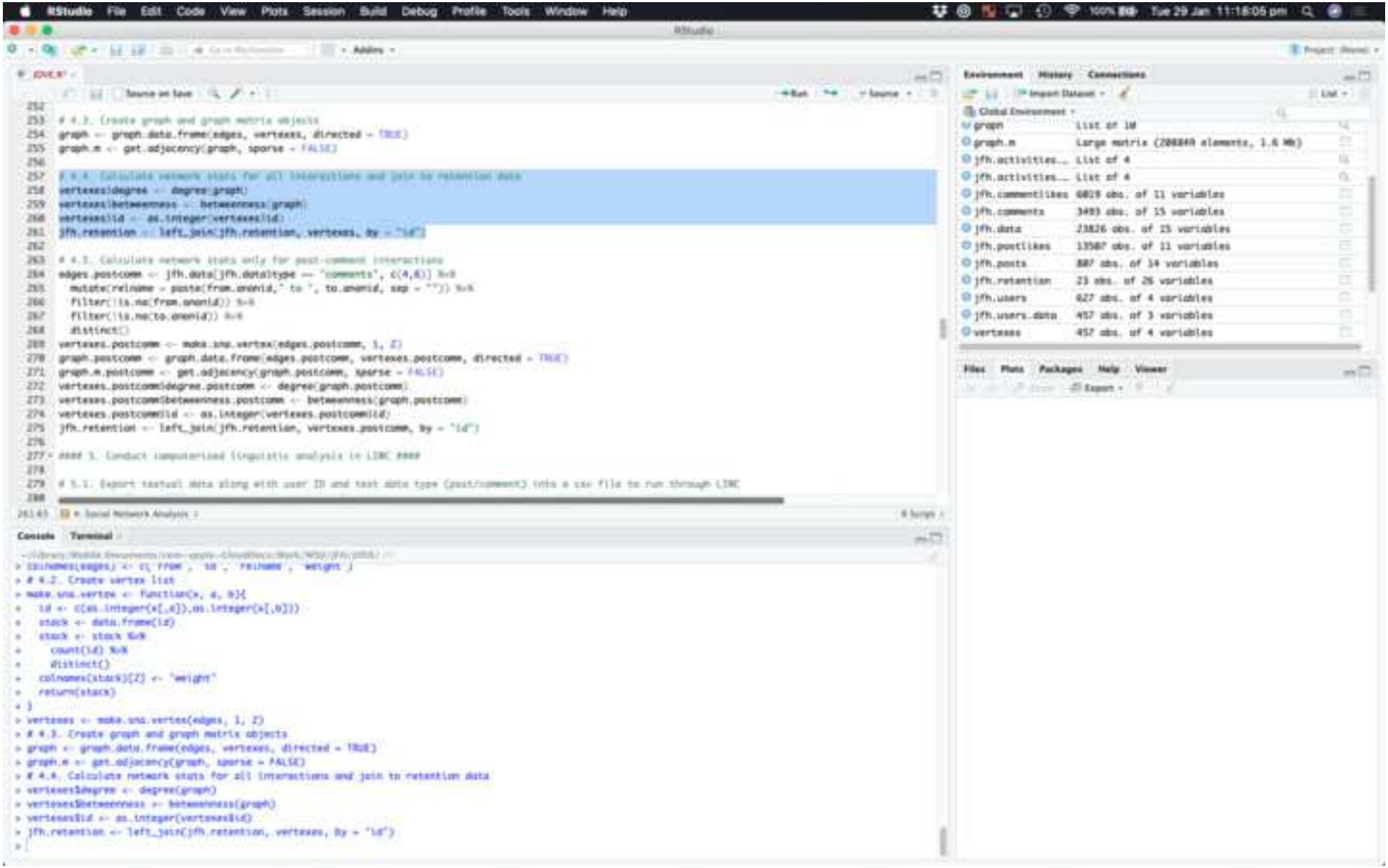
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);4.3.png



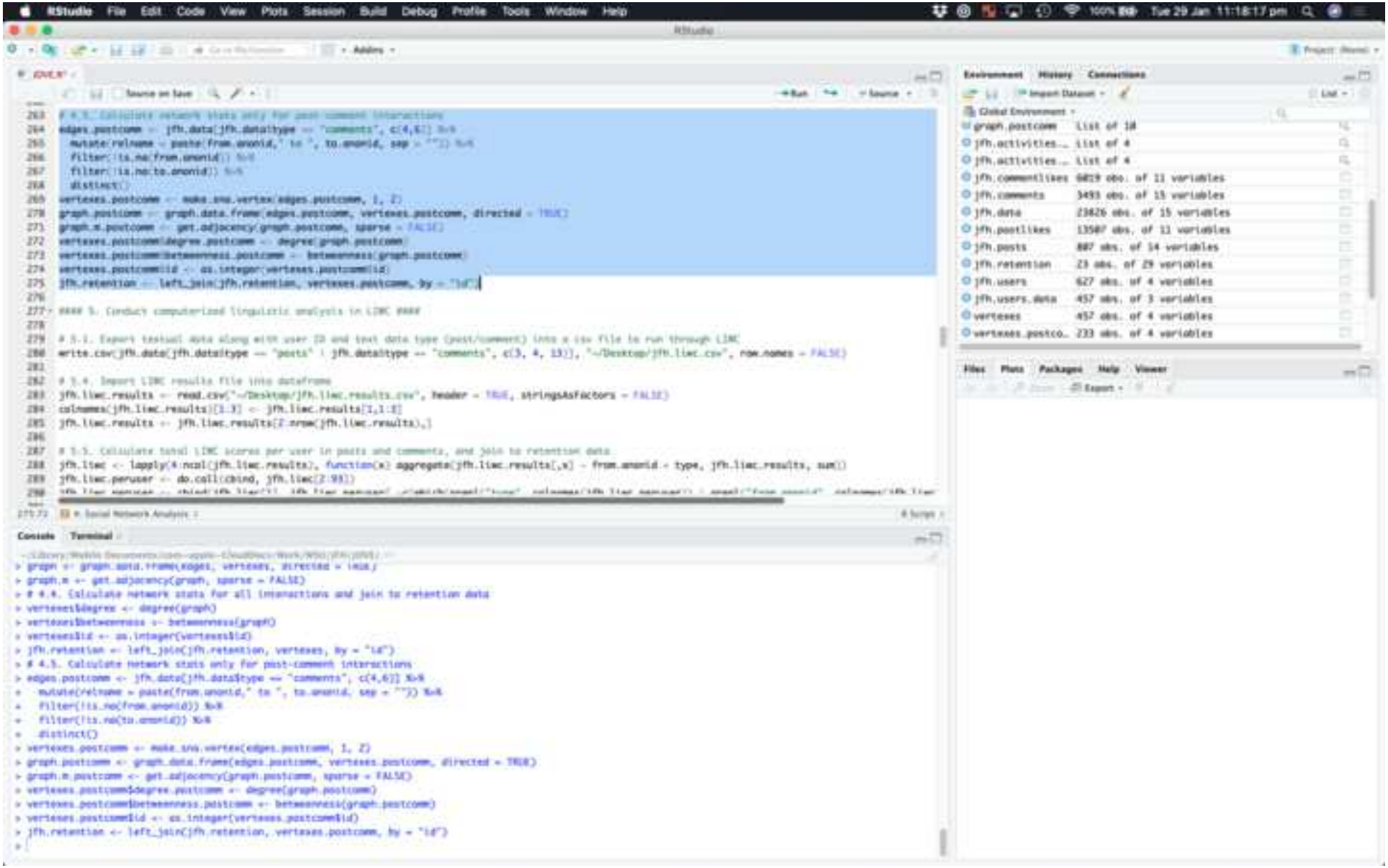
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);4.4.png

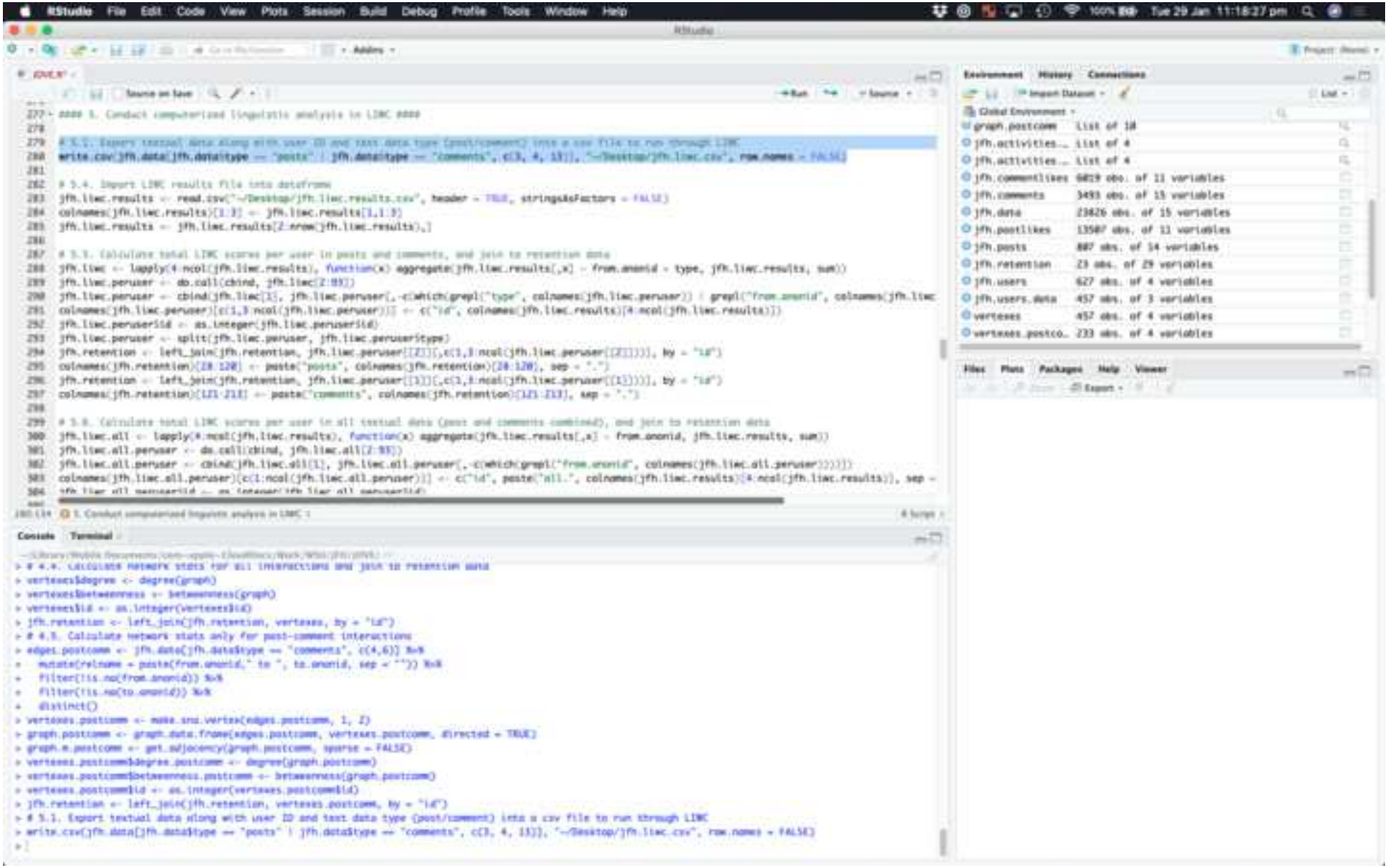


Supplemental File (Figures, Permissions, etc.)

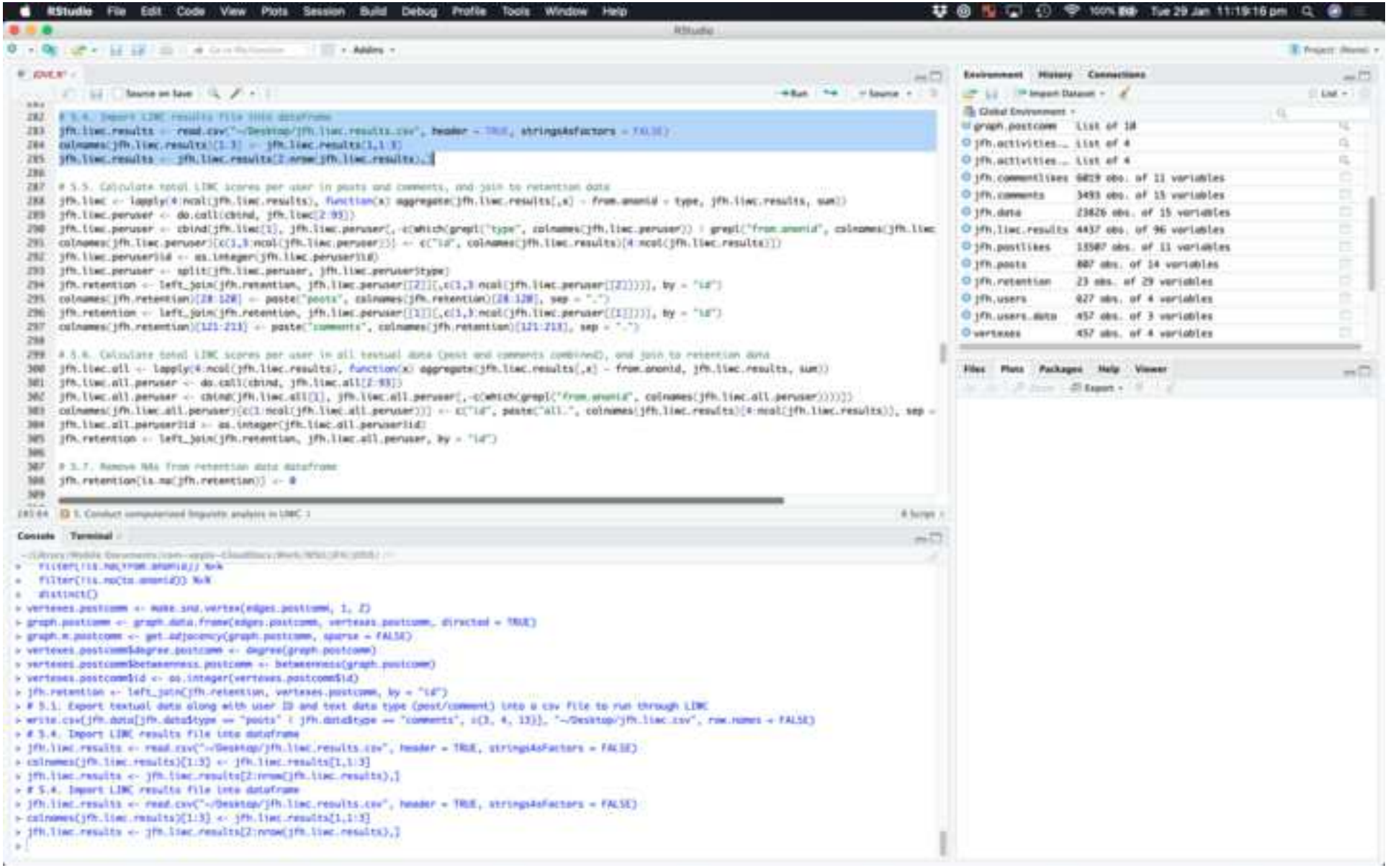
Click here to access/download;Supplemental File (Figures, Permissions, etc.);4.5.png



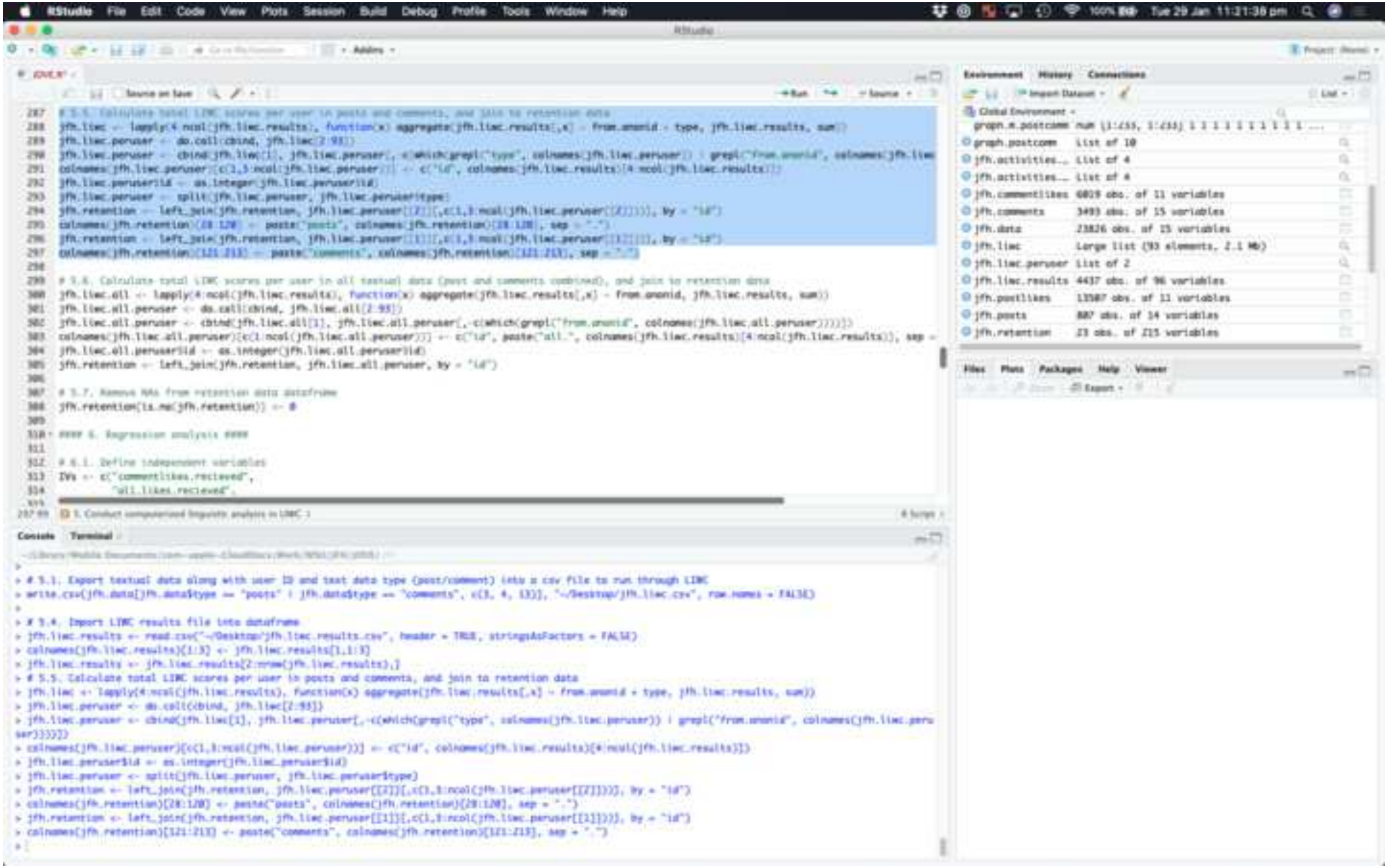
Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);5.1.png



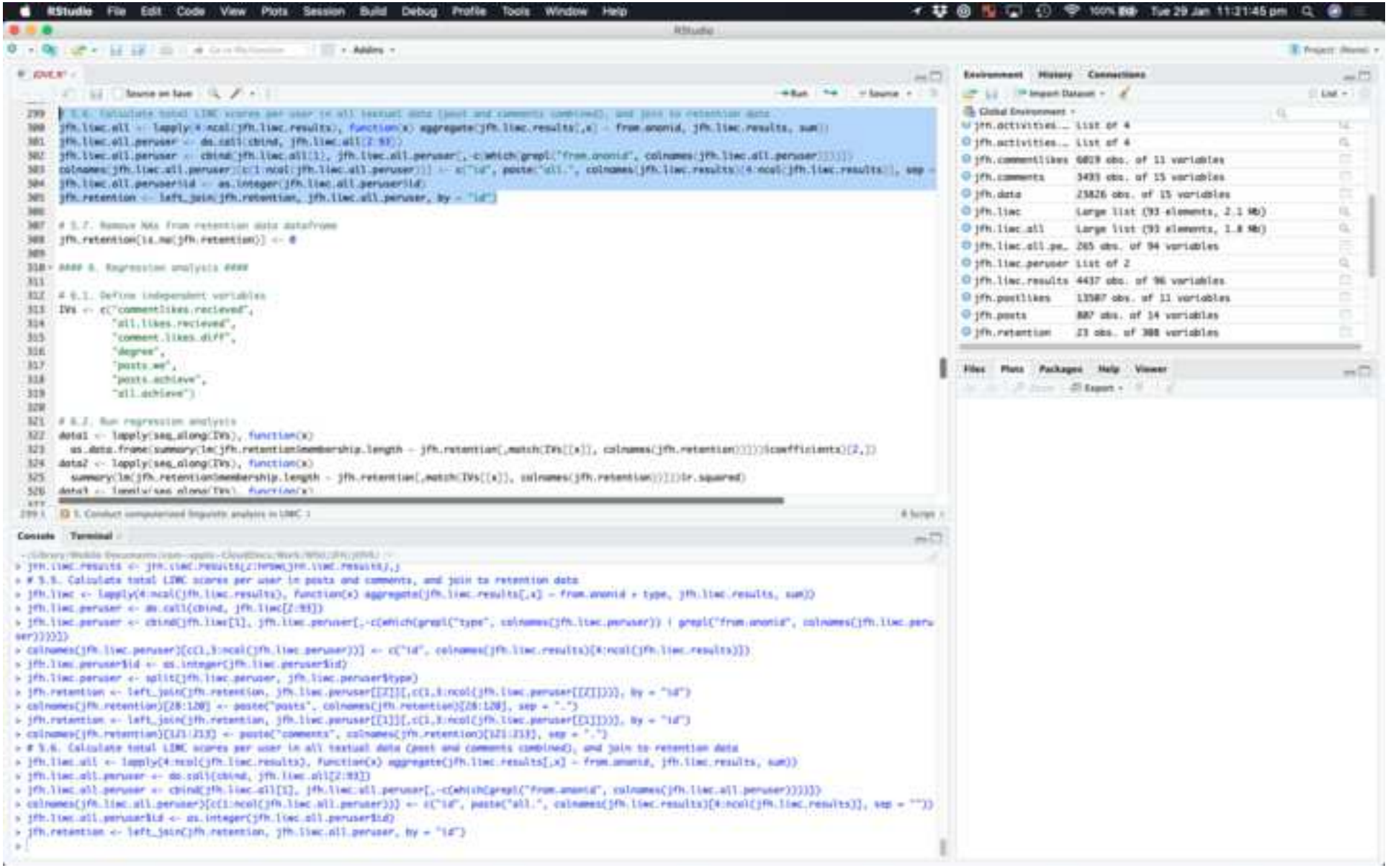
Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);5.4.png



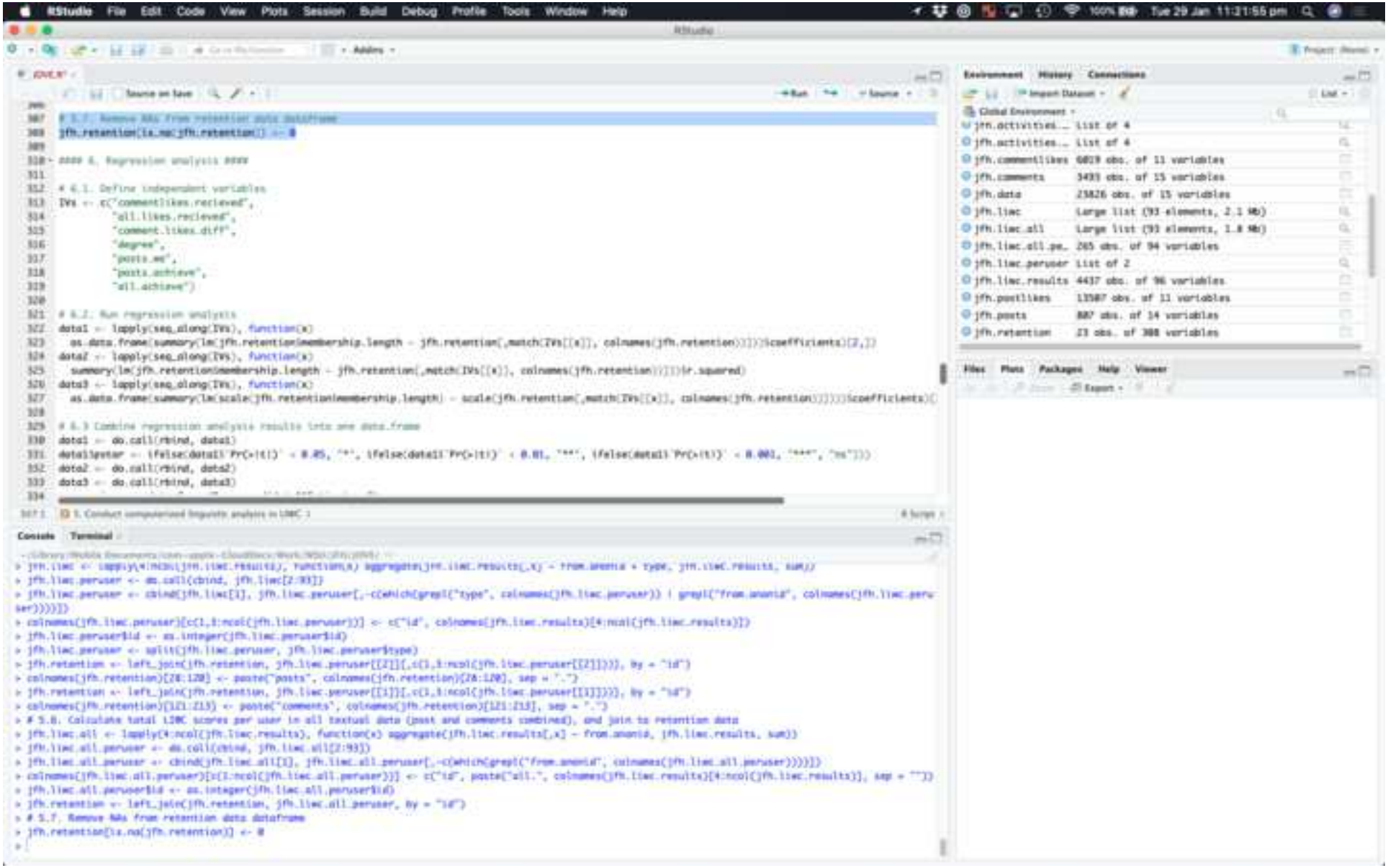
Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);5.5.png



Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);5.6.png

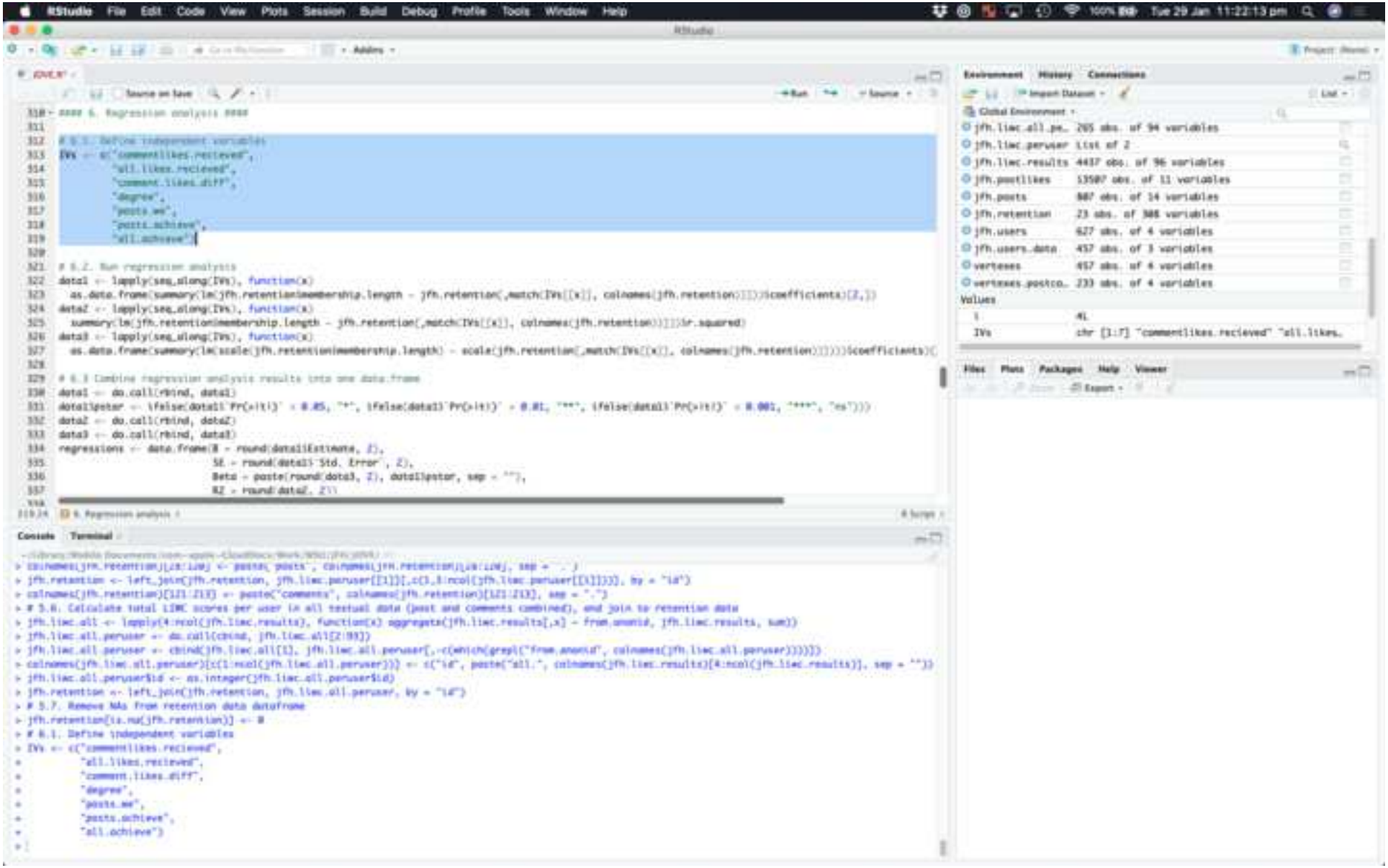


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);5.7.png



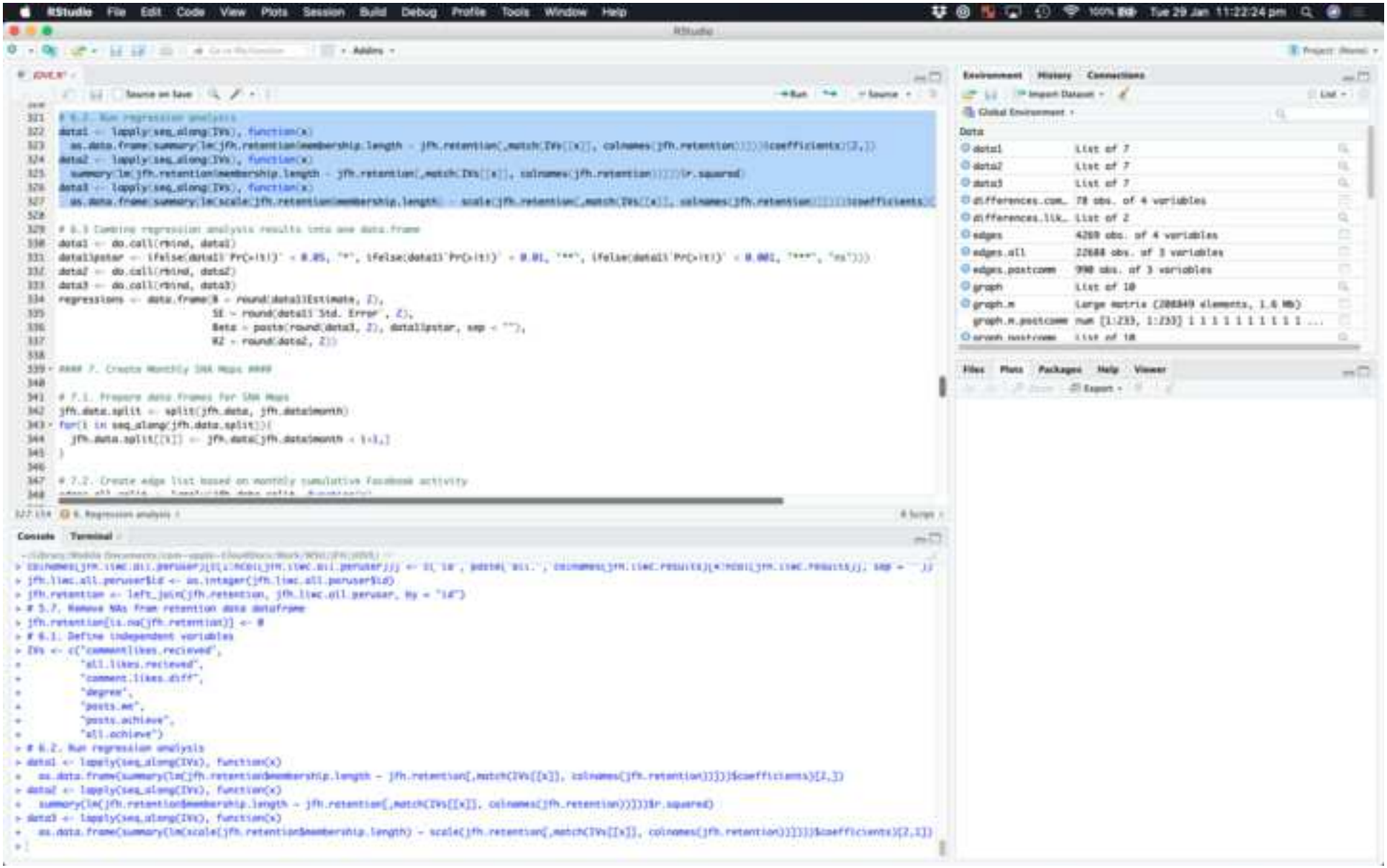
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);6.1.png

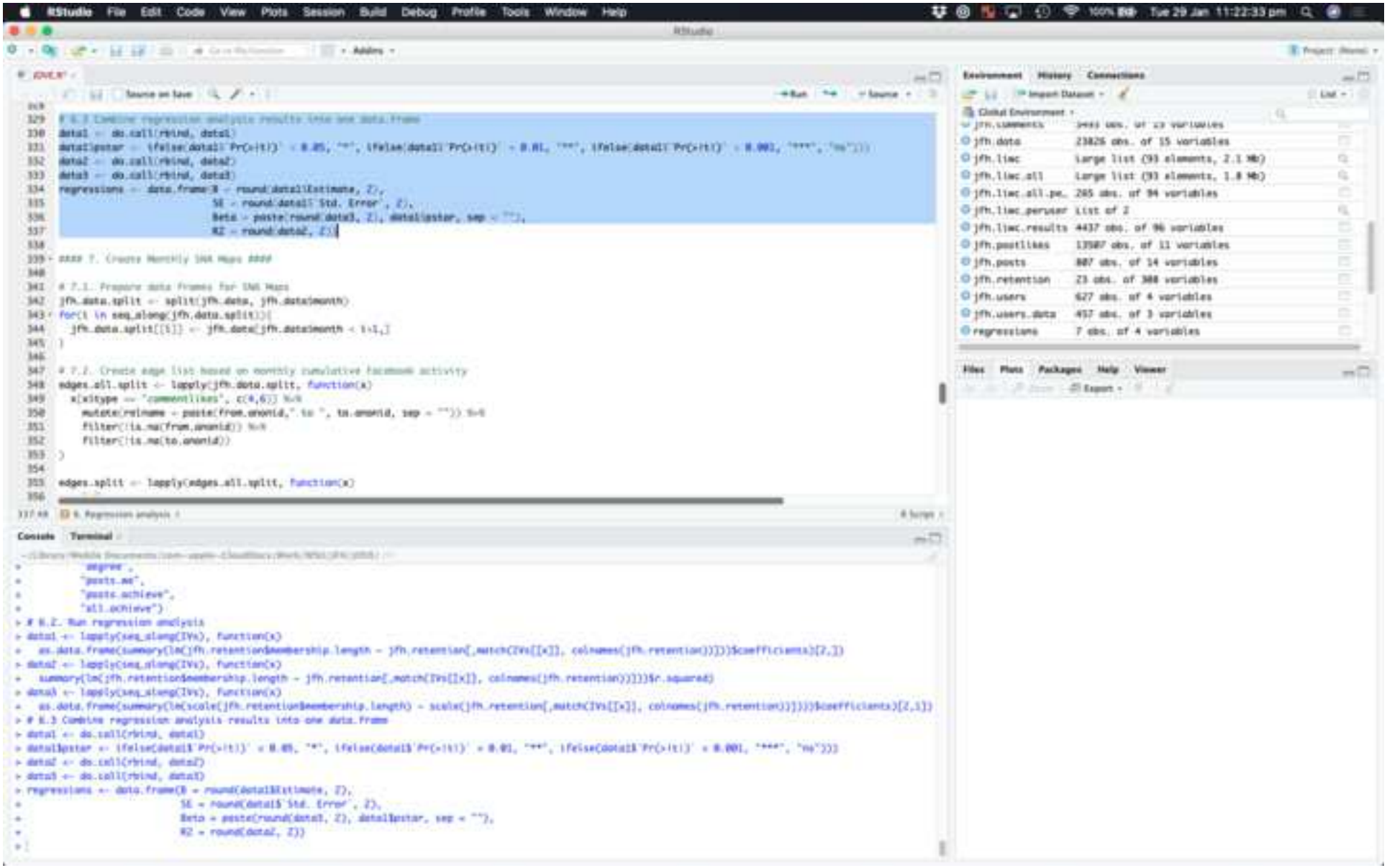


Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);6.2.png

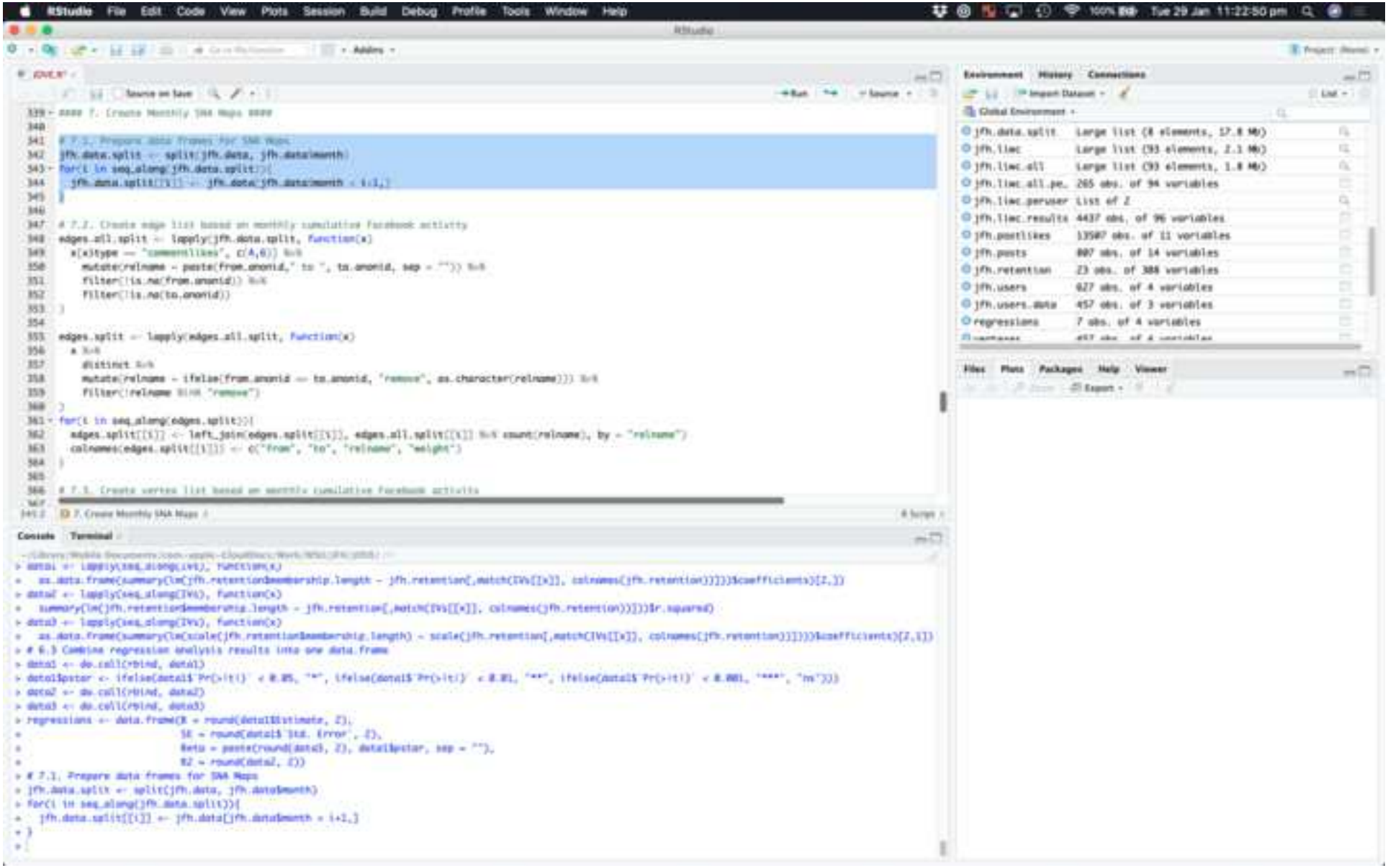


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);6.3.png

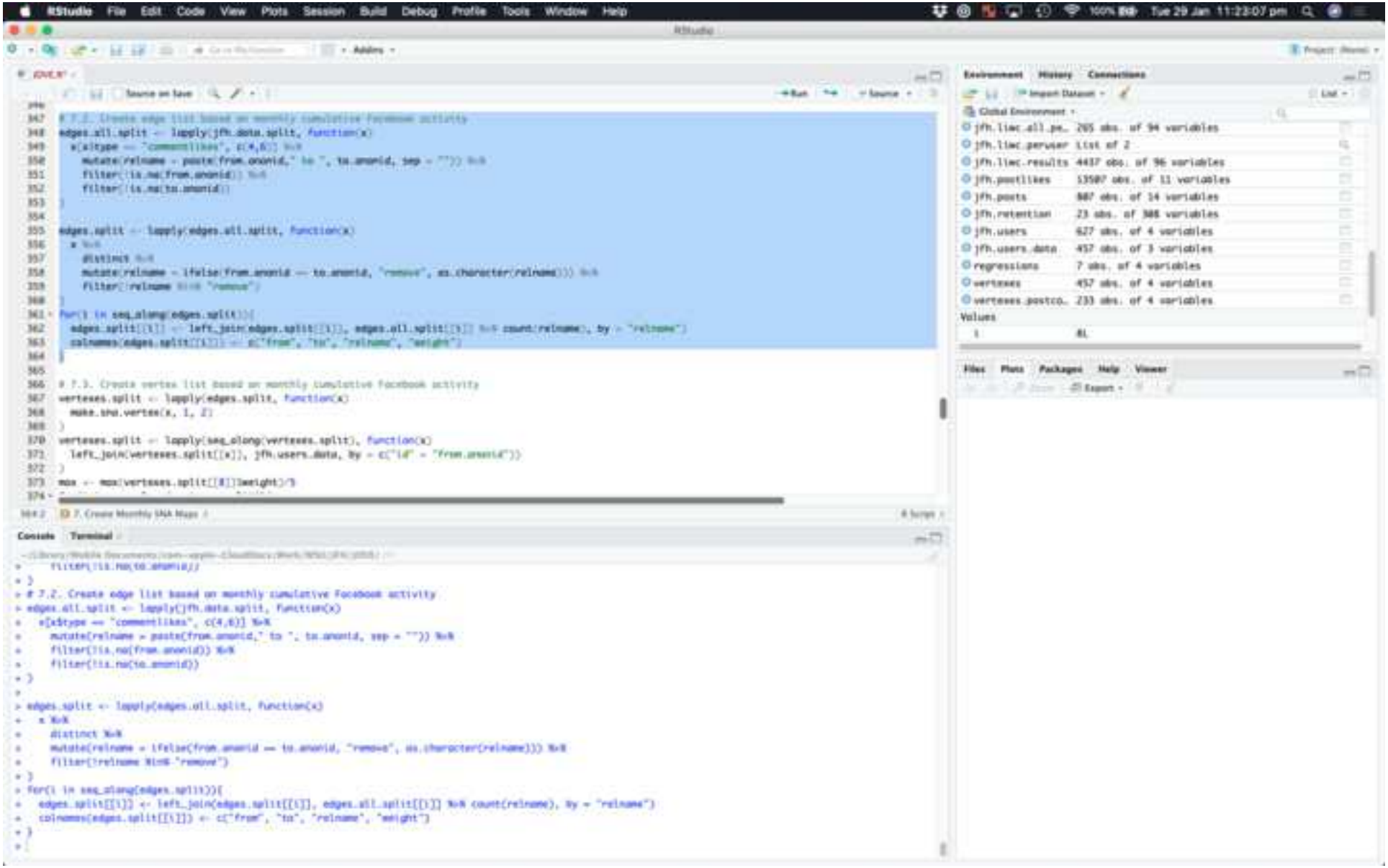


Supplemental File (Figures, Permissions, etc.)

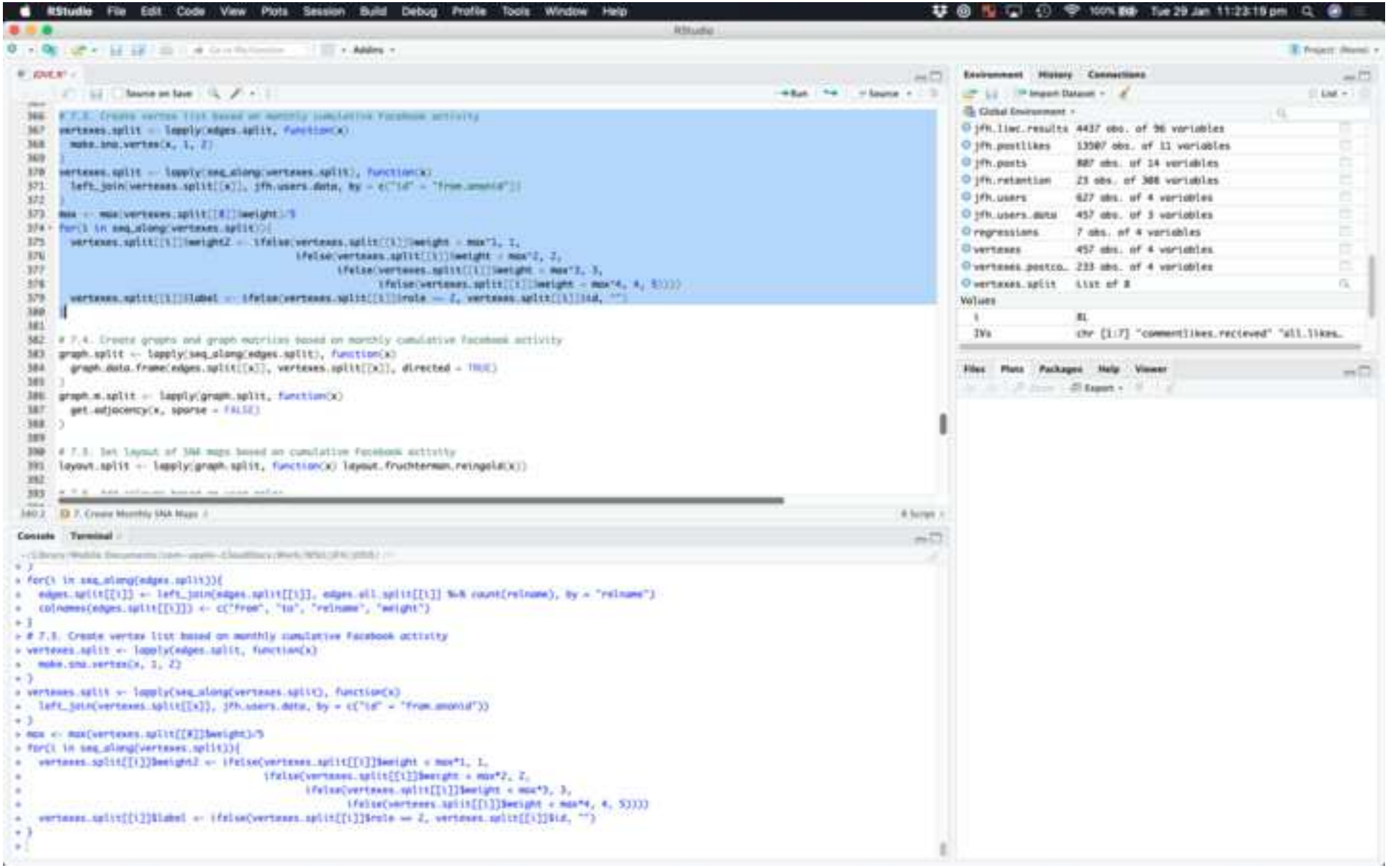
Click here to access/download;Supplemental File (Figures, Permissions, etc.);7.1.png



Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);7.2.png

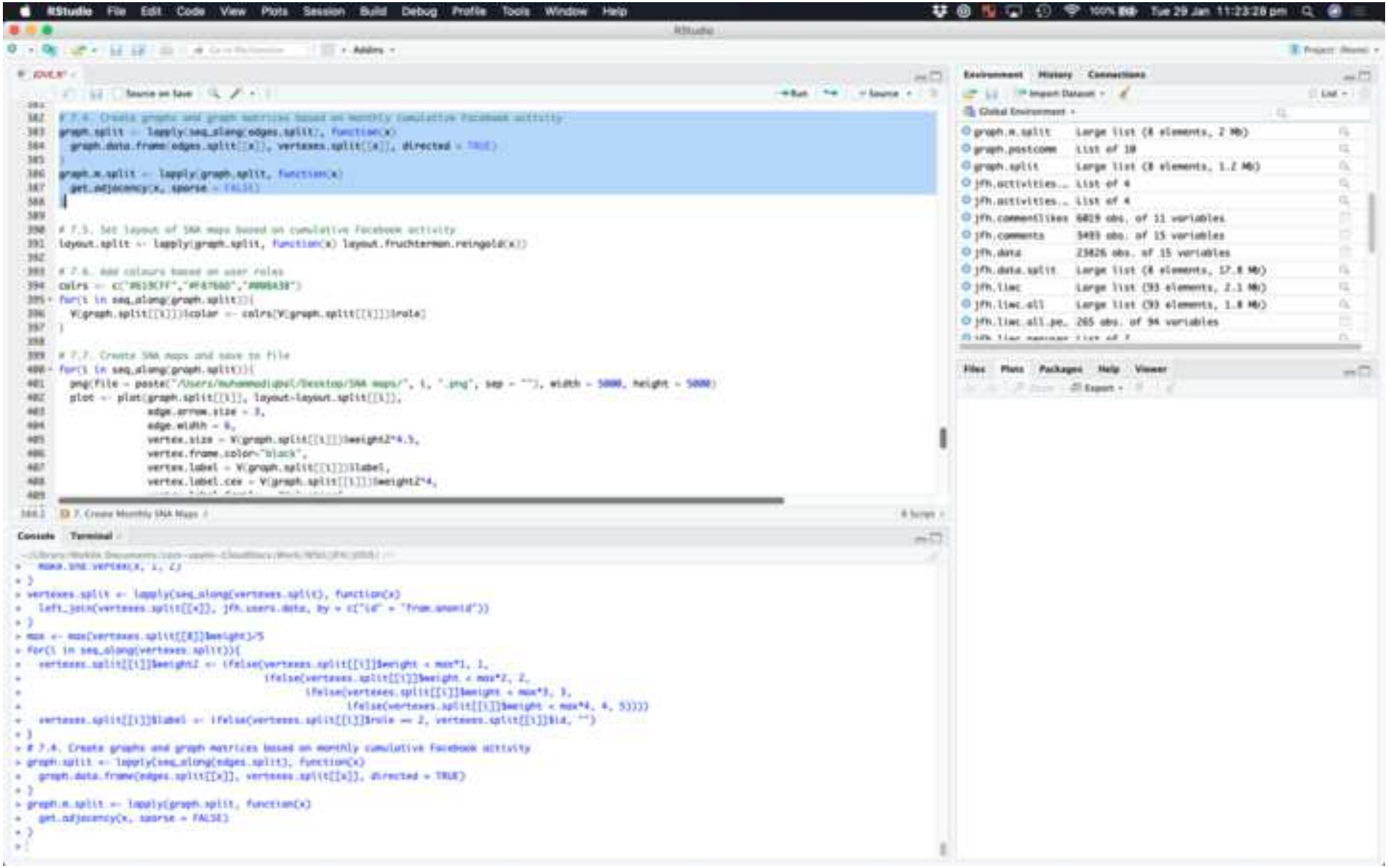


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);7.3.png

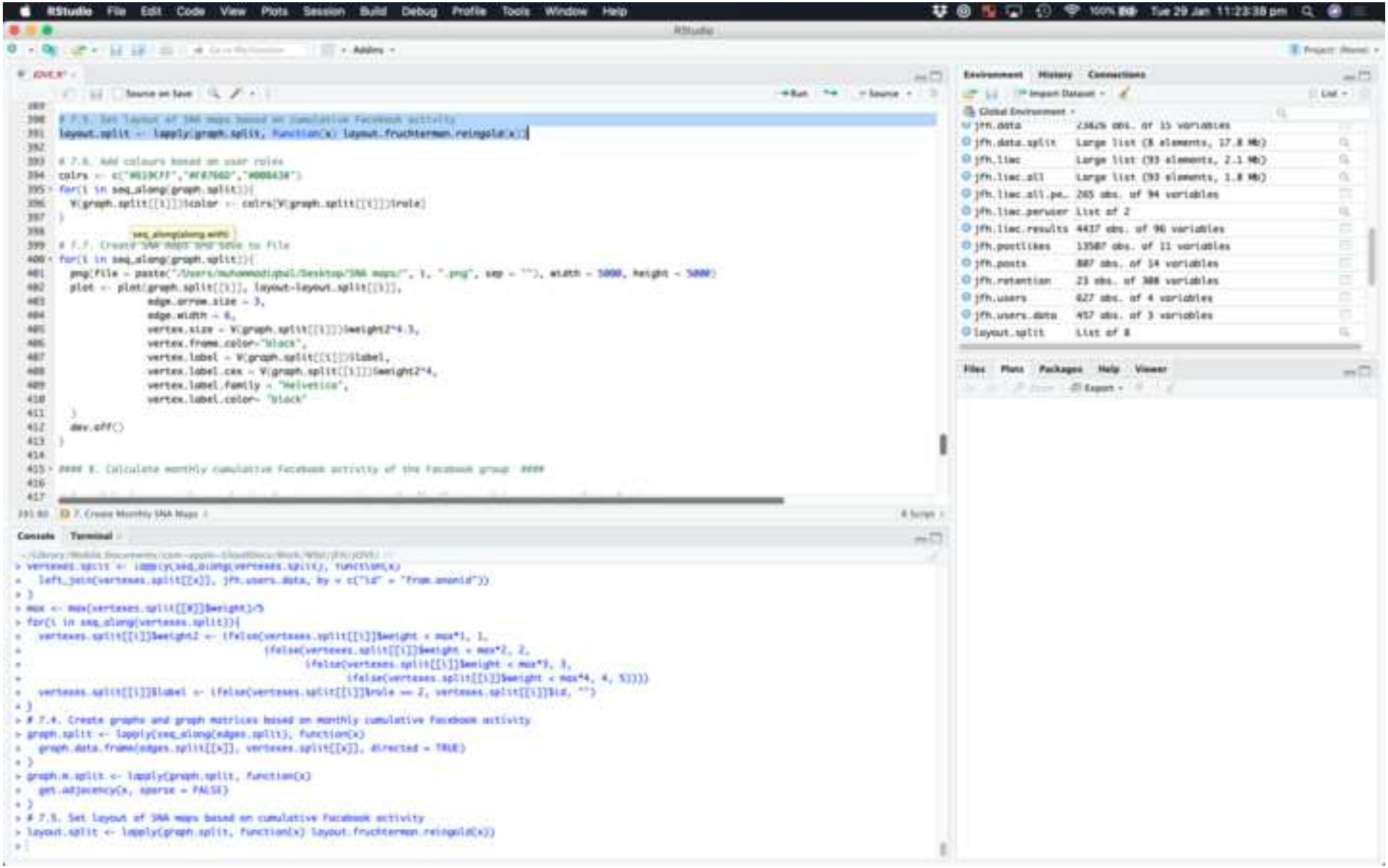


Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);7.4.png

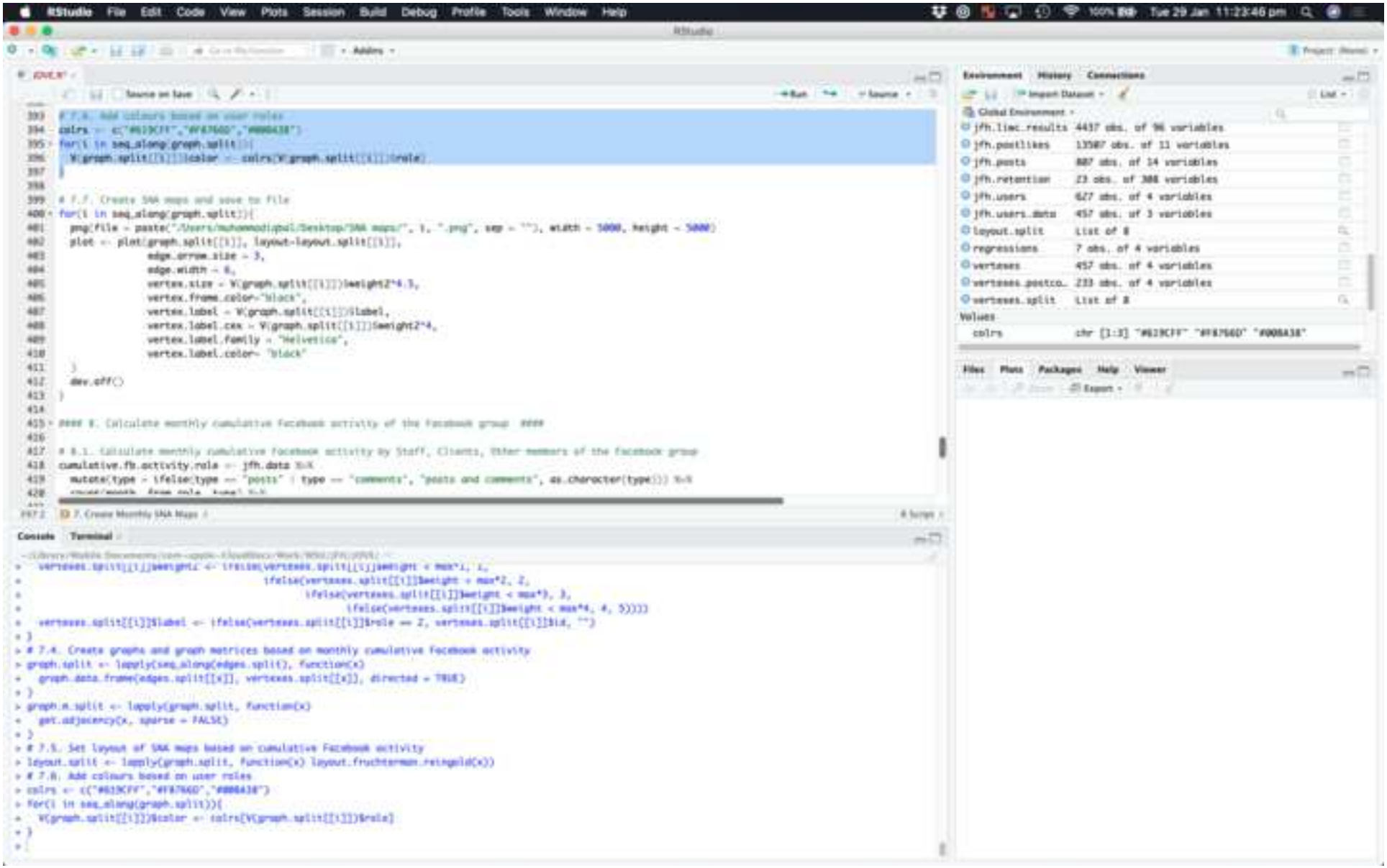


Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);7.5.png



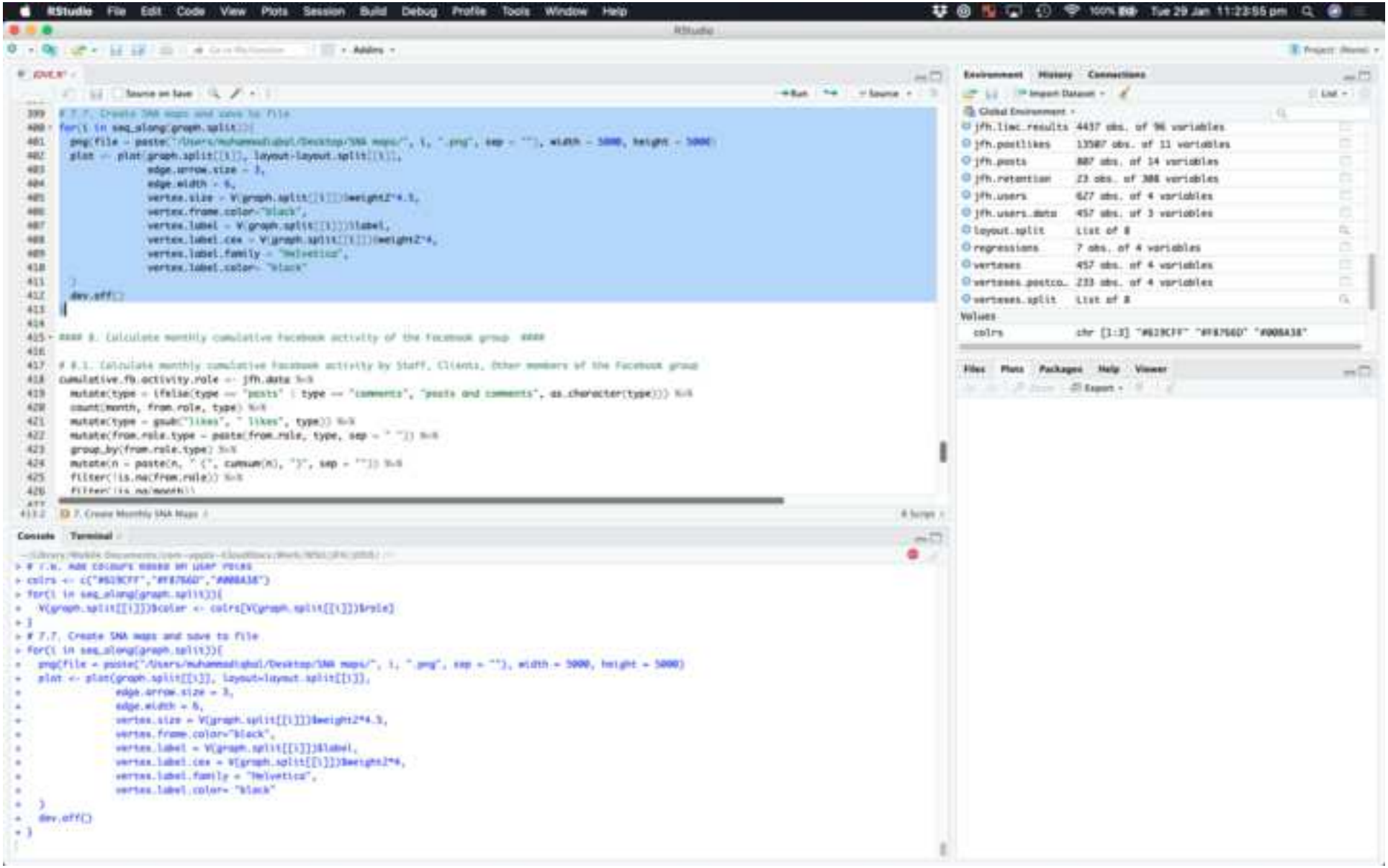
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);7.6.png



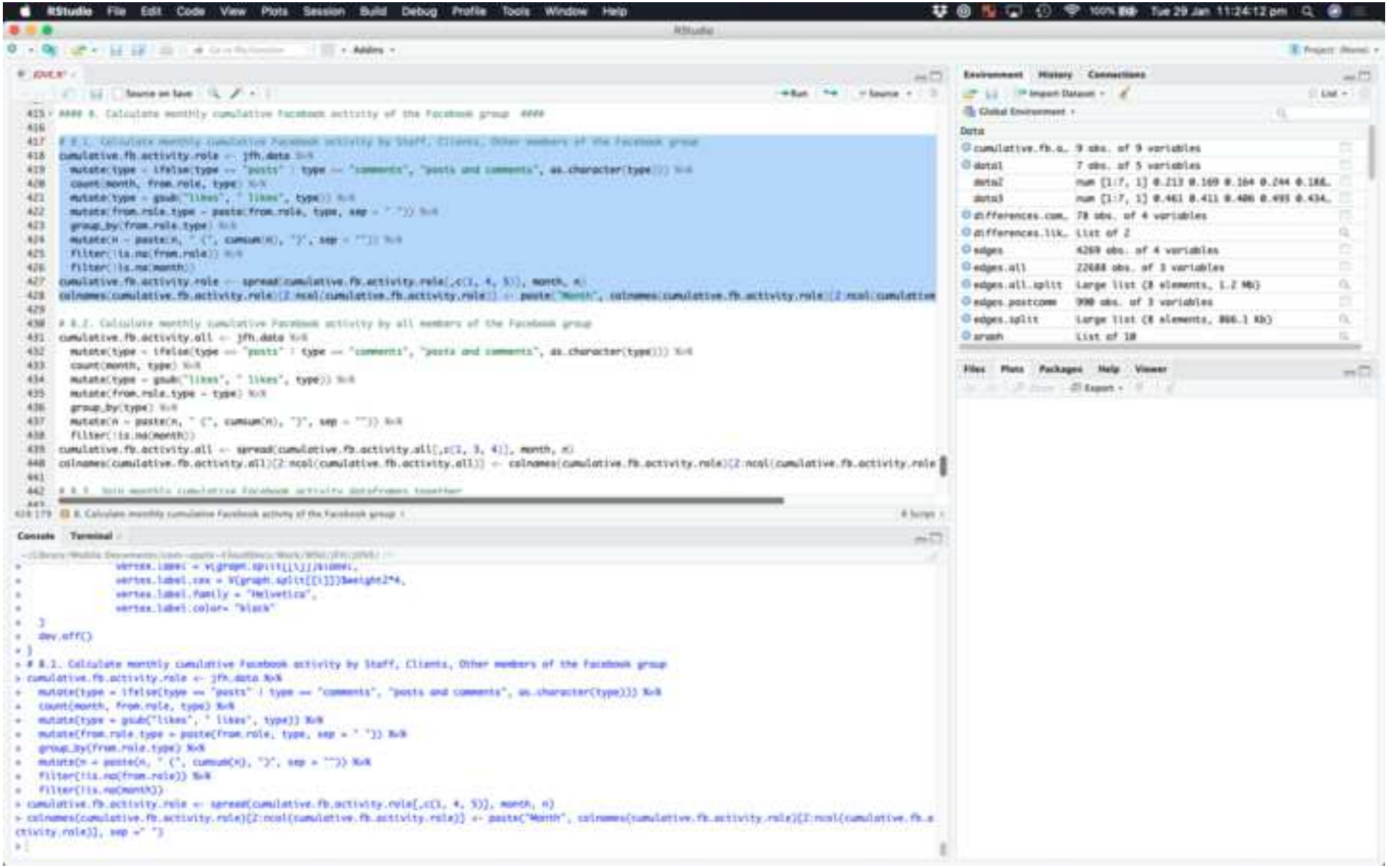
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);7.7..png



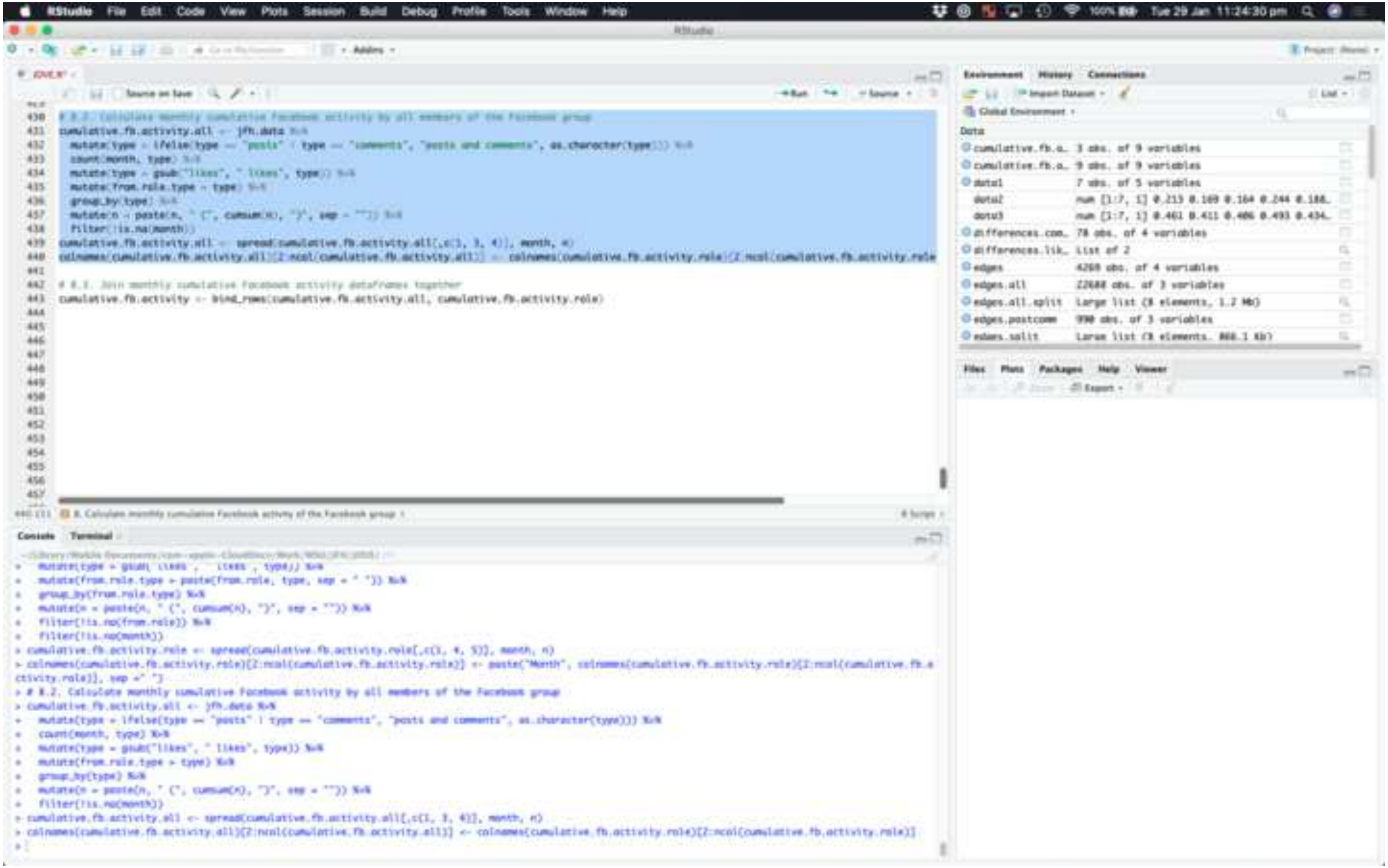
Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);8.1.png

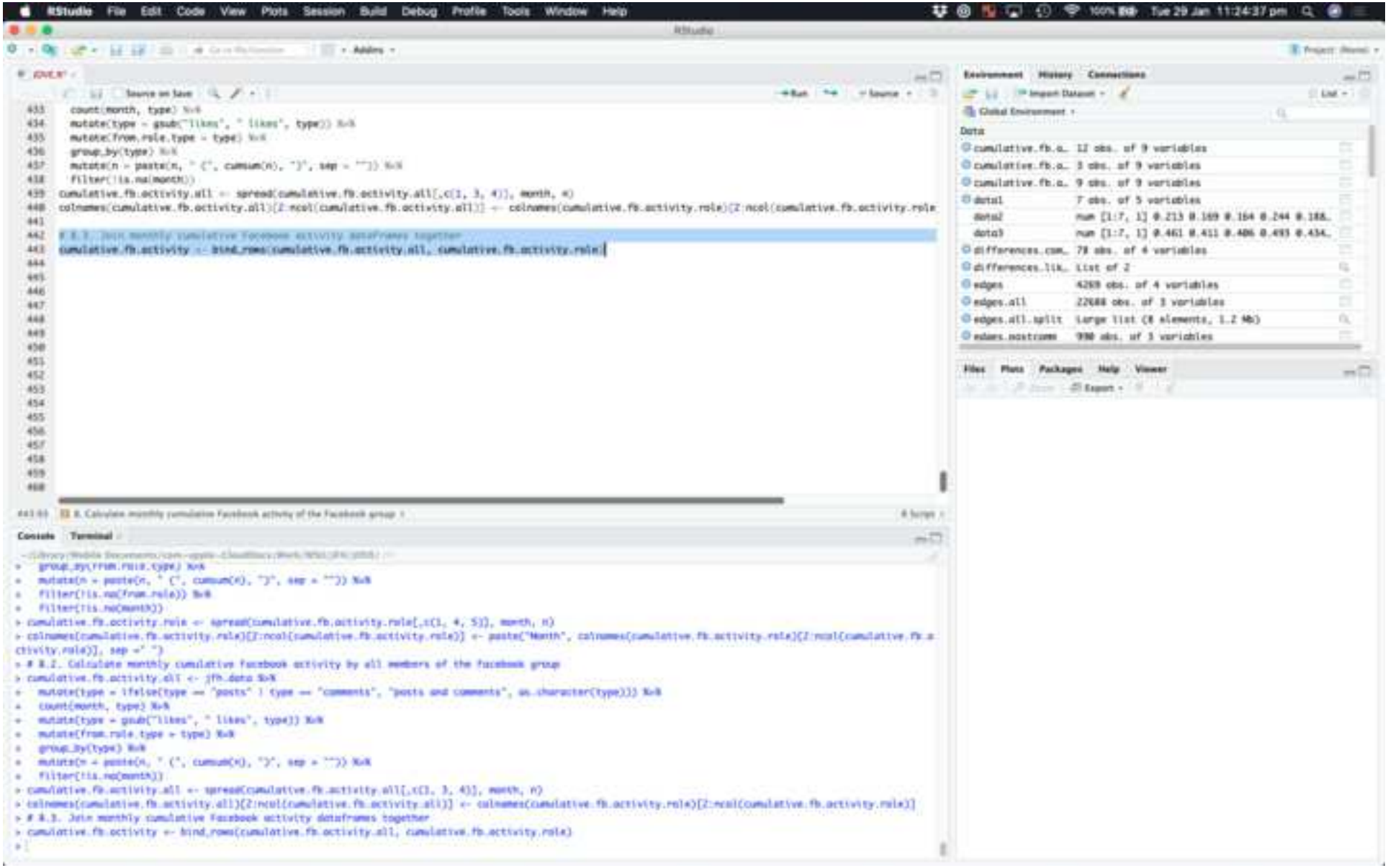


Supplemental File (Figures, Permissions, etc.)

Click here to access/download;Supplemental File (Figures, Permissions, etc.);8.2.png



Supplemental File (Figures, Permissions, etc.) Click here to access/download;Supplemental File (Figures, Permissions, etc.);8.3.png



Supplemental File 1