Social Lab: An 'Open Source Facebook'

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INTRODUCTION

Science is thoroughly influenced by the Internet (Reips, 2008). The Internet, 'Web 2.0', social media and recently Web3 – the evolution of networked technologies and their social use – have yielded a new generation of researchers, who have developed a new set of methods and tools for research on the Internet and its services (see e.g. Reips, 2021; Reips and Birnbaum, 2011; Reips and Buffardi, 2012). Tools available for such research include: *FactorWiz* and *SurveyWiz* (Birnbaum, 2000); *iScience Maps* (Reips and Garaizar, 2011); innovative social location-aware services for mobile phones like *MUGGES* (Klein and Reips, Chapter 24, this Handbook), *Scientific LogAnalyzer* (Reips and Stieger, 2004); the *Web experiment list* (Reips and Lengler, 2005); the *Web Experimental Psychology Lab* (Reips, 2001); *WEXTOR*, a Web experiment generator (Reips and Neuhaus, 2002); *ReCal OIR* (Freelon, 2013); *VAS Generator* (Reips and Funke, 2008); *Dynamic Interviewing Program* and *User Action Tracer* (Stieger and Reips, 2008, 2010); *Samply* for mobile experience sampling (Shevchenko et al., 2021), among many others. The number of studies conducted via the Internet with such tools has grown almost exponentially since 1995 (Reips and Buchanan, 2021; Reips and Krantz, 2010).

In the following sections, we will describe a new tool in this tradition, *Social Lab*, and how it can be used in research. We will also illustrate its application with an example, in which Social Lab is used to learn and practice privacy management in social networking sites. We will then provide instructions on how to extend its functionality for particular research purposes by configuring so-called 'social bots', automated agents within Social Lab that to the user may often appear indistinguishable from human users of the social network.

SOCIAL MEDIA RESEARCH OPTIONS AND BIG DATA

'Social media is a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user generated content' (Kaplan and Haenlein, 2010: 61). Figure 29.1 empirically shows with a Google Trends analysis how the term 'social media' became more popular
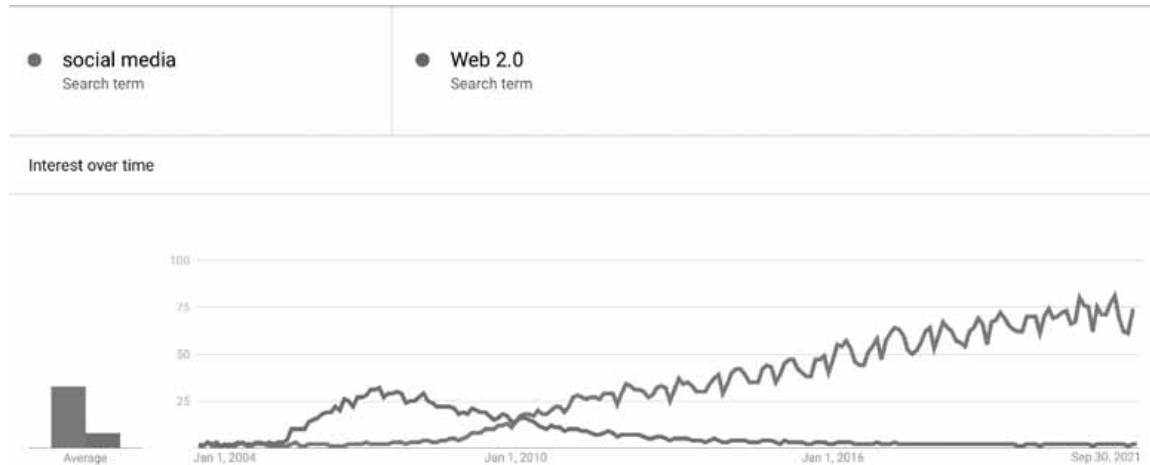
Figure 29.1   Analysis of searches for the terms 'social media' and 'Web 2.0' over time in Google Trends

than 'Web 2.0' and continues to be on the rise. By 2022, its technical foundation has been widely accepted and thus its definition has changed and diversified, as Nau et al. (Chapter 2, this Handbook, p. 15) exemplify: 'Social media are web-based and mobile services that allow individuals, communities, and organizations to collaborate, connect, interact, and build community by enabling them to create, co-create, modify, share, and engage with content (user- or bot-generated)'.

Unknown to many people, who may just know about the most popular social media sites like Facebook, Twitter, Instagram, Twitch, TikTok, Weibo, LinkedIn, or YouTube, there are thousands more social media that often aim at particular interests or groups (see Gow, Chapter 39, this Handbook). For example, Wikipedia lists almost 400 'major active' sites (Wikipedia, 2021), including many 'second level' SNSs for special, albeit large, interest groups – for example, academics (ResearchGate, Academia.edu, etc.). Social media can be categorized in various ways – e.g., by main user function (publish, share, discuss, lifestream, microblog, livecast, play in virtual world or a social game), or industry purpose (social advertising, marketing, analytics, streaming, social data mining, social intelligence, social scoring, internal or external business software, reviewing, social shopping, social referral, content curation, social TV, social brand engagement, etc.).

Research using social media can be conducted on many topics of social interaction that don't require physical co-presence or a synchronous face-to-face situation. Social phenomena have been shown to appear online as well as offline – see, for example, research on ostracism (Vorderer and Schneider, 2016) or migration (Oiarzabal and Reips, 2012; Reips and Buffardi, 2012). Communication in social media and the effects of social media use (e.g. emotional consequences of using Facebook (Lin and Utz, 2015), or even Facebook addiction (Dantlgraber et al., 2016)) have become a topic of interest and research in itself. Both the research on social media use and on how social media can be used for research purposes have increased enormously during the last few years (also see Nau et al., Chapter 2, this Handbook).

Because very large social media like Facebook have been frequently involved in research, data sets tend to be very large. Big Data has thus become an important topic in social media research and Internet science, with related issues. Big Data gathered from social media may in fact provide answers to one of the key issues in behavioural and social science research with very large data sets, the lack of connection between the micro and macro levels of analysis (Snijders et al., 2012). In a recent promising example with a smaller corpus of digital traces of 62,114 Twitter users after the Paris terrorist attacks of November 2015, Garcia and Rimé (2019) connected the micro and macro levels for emotion words, providing hope that the issue would eventually be solved. In a similar vein, Porat et al. (2019) analysed more than 700,000 tweets about a case in Spain where an unvaccinated child contracted and later died from diphtheria, and found that understanding the characteristics of these tweets in the context

of vaccination could improve efforts by health promotion professionals to increase their reach and impact.

To select a social media site for research or other purposes, a scholar could use a tool called Social Media Planner. In a first step, the scholar could select demographics and interests, and in a second step, the tool could generate a list of social media sites that were geared toward the selected criteria (e.g. education) and were used by (mostly) people within the selected range of demographics.

On the downside, existing social media come with many disadvantages related to their often proprietary nature (advertisements; lack of true access to the data; end of service due to economic issues like buyout, bankruptcy, change of business; business rather than research driven structure of data; change of service, etc.) and sampling biases (see Hollingshead et al., Chapter 7, this Handbook). Even though his methodology of using Facebook likes may be somewhat questionable with respect to details of the empirical results, Ruffini (2012)

convincingly describes how the selection of a social media service may lead to a particular, possibly biased, sample. The recent example of Facebook suddenly cutting off researcher access shows another disadvantage of existing commercial social media sites (Ortutay, 2021).

SOCIAL LAB: WHAT IT IS

Social Lab can be described as an open source 'Facebook' clone, a fully functional and free software to run social networks for research and other purposes (Garaizar and Reips, 2014). Social Lab is available from http://www.sociallab.es and provides most features commonly found in other social media – for example, messaging, sharing, befriending, wall posts, pictures, searching, profiles, privacy settings, etc. (see Figure 29.2).

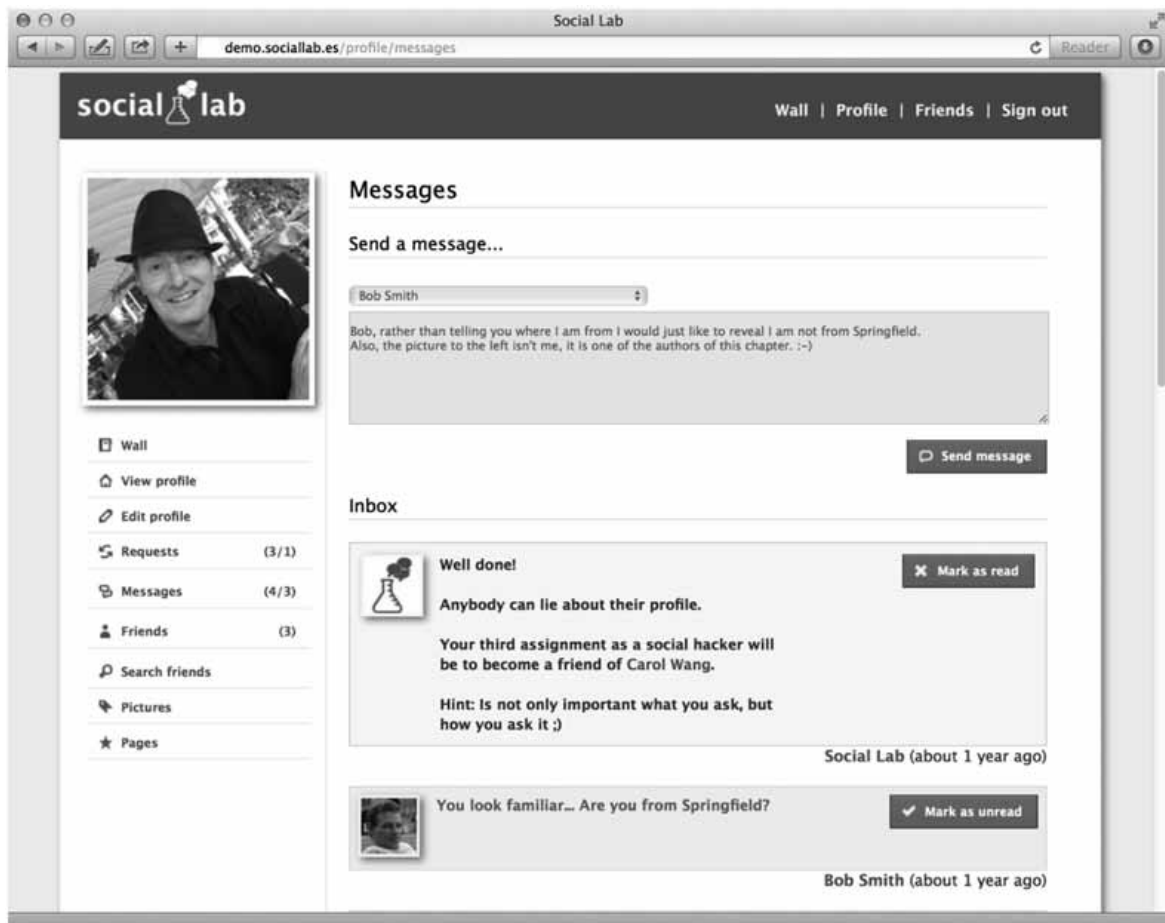Having full availability of navigation and communication data in Social Lab allows researchers

Figure 29.2   Main display of social lab

to investigate behaviour in social media on an individual and group level. Automated artificial users ('social bots'; for a similar concept of *social bots* not native to a social media see, e.g. Boshmaf et al., 2011) are available to the researcher to simulate and stimulate social networking situations. These bots respond dynamically to situations as they unfold and they have a memory of their previous interactions. The social bots can easily be configured with simple scripts and can be used to experimentally manipulate social networking situations in Social Lab.

AN EXAMPLE: AN EDUCATIONAL PRIVACY MANAGEMENT SITE USING SOCIAL LAB

To exemplify how Social Lab can be used, we set up a Social Lab site that helps users develop a sense of the challenges around privacy management in social media. Privacy on the Internet has been and continues to be a major issue (Joinson et al., 2010; Reips, 2011). The Social Lab privacy education site is available in English at http://en.sociallab.es/ (998 users), in Spanish at http://es.sociallab.es/ (3,822 users), in German at http://de.sociallab.es/ (155 users), and in Basque at http://eu.sociallab.es/ (88 users). Its purpose is to demonstrate some of the techniques used by social hackers in order to enable users to prevent this kind of attack in real social networks.

Anyone can sign up and get started with this site. Once signed in, the first challenge in protecting users' privacy is waiting in the inbox. Every challenge will be controlled by an automated, script-based profile that appears like a fellow user on the social network. Profiles must be convinced to become friends using social engineering skills. Social bots' responses are automatic but may not be immediate. Sometimes they need some time to respond, just like real users.

Figure 29.3 shows how the site provides feedback to users. The 10 challenges in the privacy

management example site and their associated profiles are based on social bots, an essential feature of Social Lab. Why would such bots be important in research in social media? Participants' interactions with bots or different features of social networks can tell us something important about social interactions, in controlled ways: because we reduce possible variation to zero (we control the bot and the features), we know exactly what causes a respondent's behaviour. In the next section, we will explain how to create and program bots in Social Lab.

PROGRAMMING A BOT IN SOCIAL LAB

From a technical perspective, Social Lab's bots are regular user accounts provided with unattended behaviours. Therefore, researchers can make a social bot from a user account previously managed by a person (person–bot switch). The opposite is also feasible: a person can take manual control of an account previously managed by a social bot (bot–person switch). Moreover, *sharing* the management of the user account between a person and a social bot at the same time is also possible. This flexibility in managing social bots' accounts enables a wide variety of research scenarios.

The first step to programming a bot on Social Lab is to create a user account and define its profile (i.e. first name, last name, email, gender, birthday, picture, location, academic information, personal information, privacy options) using the registration page (http://yoursociallab.com/signup). We use 'yoursociallab.com' as a fictitious server name where Social Lab is deployed by a research group. Most of these features are in use in our online privacy game example described in the previous section. Therefore, the reader can replace 'yoursociallab.com' with 'en.sociallab.es' to see them working. The rest of the process of defining the automatic behaviour of the social bot is done through the Social Lab backend interface (i.e. http://yoursociallab.com/backend.
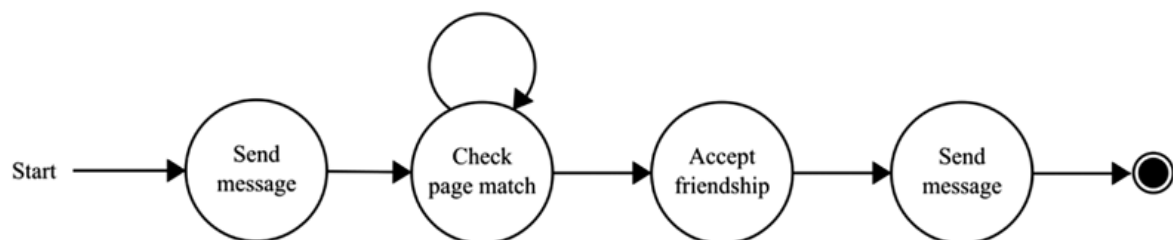

Figure 29.3   Simple social bot for social lab

php – for security reasons this URL won't work in our example at http://en.sociallab.es to prevent hackers from accessing our privacy game backend).

In Social Lab, the behaviour of a social bot is defined by a sequence of steps. There are two types of steps: actions and checks. *Actions* (e.g. send message, accept friendship request, etc.) are executed in a predefined order and always enable the processing of the next step. *Checks* (e.g. check if someone is a friend of two friends of mine, check location match, etc.), by contrast, are evaluated whenever they are requested by the social bot, but they do not allow the bot to process the next step unless their condition is met.

Social bots keep in the database the status of each interaction with each user. Thus, they may be running step 1 with user A while performing step 3 with user B. When a social bot has executed all the steps defined in its behaviour interacting with a given user, this interaction ends. However, interactions with other users will run their course in the state and order in which they were.

Let's see how to define the behaviour of a simple bot. As shown in Figure 29.3, this bot will send a message asking the user whether they like Mozart or not in the first step. In the second step, the bot will wait until the user it is interacting with adds the Mozart page to their preferences. The bot will wait in this state indefinitely and will not execute the rest of its program until the condition is met. When that is the case, the bot will accept the user's friendship request (third step) and send a message recommending other pages of similar musicians (fourth step).

Defining this automatic behaviour in Social Lab is straightforward. First, a regular user account is created; it must then be added to the 'Bots' table using the backend application (http://yoursocial-lab.com/backend.php/bot/new). Then, all the steps defined in Figure 29.3 have to be added to the 'Steps' table (http://yoursociallab.com/backend. php/step/new), setting the following parameters (see Figure 29.4): 1) the bot that we are programming (a drop-down list of all bots defined in the

Figure 29.4   Setting up triggers and routines for a social bot in social lab's backend application

'Bots' table is shown here to minimize input errors); 2) the command to be executed in this step ('Send message' for the case of the first step of this social bot); 3) the step order (0 for the case of the first step); and 4) a reference to the message intended to be sent. All text messages sent by social bots have to be stored in the 'Automsg' table. Therefore, it is necessary to add a new entry to this table (http://yoursociallab.com/backend.php//automsg/new), indicating the text to send. The second step of the social bot has to be added in a similar way, adding a new entry to the 'Steps' table (http://yoursociallab.com/backend.php/step/new). In this case, the command should be 'Check page match', the step order should be 1, and the automsg field should be left blank because this check does not require a message. The third step is defined in the same vein, adding a new step for the same bot and defining the command (accept friendship) and the step order 2). Finally, the last step of creating this bot involves another 'Send message' command. Therefore, the message to send should be added previously to the 'Automsg' table (http://yoursociallab.com/backend.php//automsg/new). Once this procedure is finished, the bot is ready to interact with users of the social network.

As we can see, defining a bot in Social Lab does not require previous technical knowledge, just adding values to the database. Thanks to the backend application provided with Social Lab, these database changes can be done with a form-based interface. With this social bot definition system, a researcher could easily compare two similar situations by creating two social bots with slightly different behaviours and analysing which interactions occur with each of them. For example, in a study related to participation in online promotions, researchers might want to know whether participants asked to perform two actions (e.g. mark a page as favourite and post a message on their wall) to take part in the online promotion are more reluctant to participate than those who are asked to perform one action first and then consecutively the other one. Researchers conducting this experiment could define three bots as shown in Figure 29.5 and compare the number of users on the social media site that reach the last step in each case. Comparisons between the two last bots could also give clues about the reluctance associated with each action.

User accounts of each of these bots can also be simultaneously managed by humans. Therefore, the community manager responsible for encouraging participation in this online promotion could use the social bots' user accounts manually during some moments of the marketing campaign. This increases the feeling of interacting with a person and not a bot, which could also be the subject of another related study (i.e. compare the engagement in online promotions boosted by profiles clearly run by people and by profiles clearly managed by bots). As mentioned before, this shared management of user accounts also enables multiphase studies in which the behaviour (e.g. bot A, bot B and bot C in Figure 29.5) and type of interaction (manual vs. automated) change in each
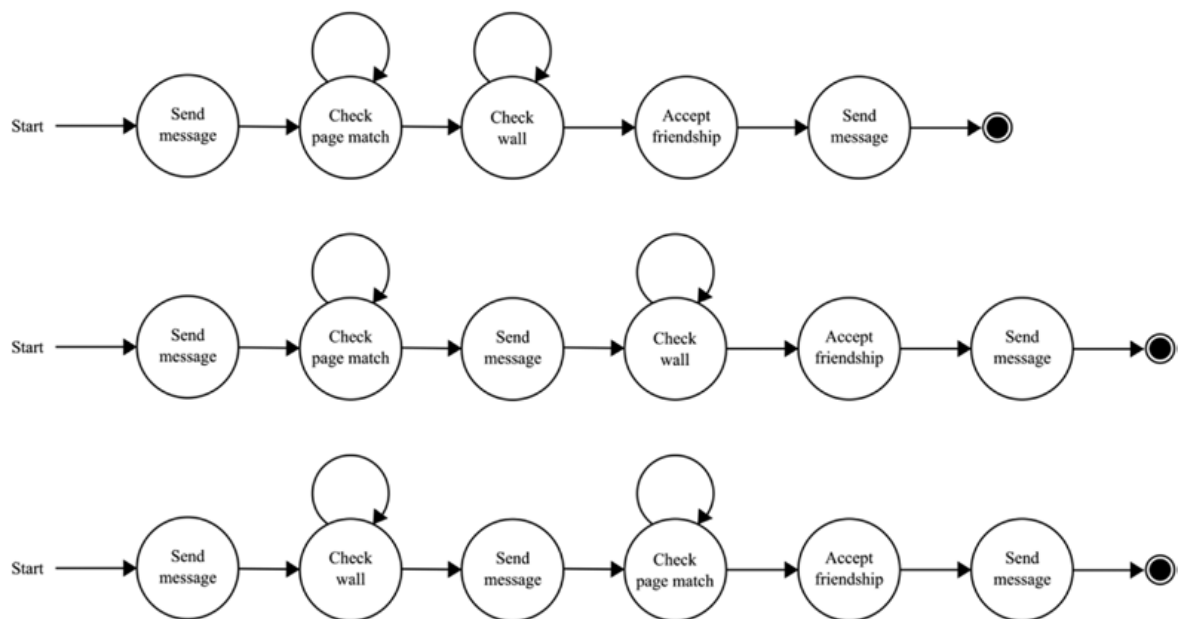

Figure 29.5   Three slightly different social bots to gather participants for an online promotion

phase, but all interactions are made from the same user account.

Moreover, it is also possible to take advantage of the fact that all behaviours of all social bots are defined as rows of a small set of tables in the Social Lab database (i.e. Bot, Step, Automsg). Thanks to this decoupled design, third-party software could dynamically reprogram the behaviour of the bots modifying the content of those tables without modifying a single line of the particular Social Lab instance's source code. This enables the integration of sophisticated behaviours (e.g. chat bots managed by complex artificial intelligence algorithms) without having to integrate their code in Social Lab, but rather simply making changes in the database.

RESEARCH OPTIONS WITH SOCIAL LAB

Here we outline ideas about how Social Lab could be used in research. In a basic study design, researchers can observe how users act and communicate within the social network. For example, in Figure 29.6, messages can be deployed by bots or researchers to provoke user action. As fully controllable open-source software, Social Lab lets researchers control more aspects and access more information than any proprietary network.

Also, researchers may use Social Lab to investigate group-level social network structure and dynamics. Social network analysis could then be used in the analysis of the social network – for example, research into changes of the pattern of connections between persons in a collective (Quan-Haase and McCay-Peet, 2016). Of course, a network set up with Social Lab can provide an environment for questionnaire studies and interviews as well. Such interviews could even be conducted automatically using a pre-programmed bot that randomly contacts users within the social network and invites them to participate (Stieger and Reips, 2008).

We could further imagine *experimental* studies that are based on Social Lab. When we published the first edition of this chapter there had been only one truly experimental study with Internet-based social networks (Centola, 2010), that is, randomly assigning participants to different social networks. (Others, like Salganik and Watts (2009), randomly assigned and provided dynamic information to study the role of social influence on the nature of success for cultural products such as books, movies, and music, but in their experiment there was no social interaction between participants.) Centola (2010) was interested in the influence of the structure of social networks on the spread of behaviour and randomly assigned participants who had signed up to a health forum to either a clustered lattice network condition or a random

Hi there, you sound very Basque to be a German, don't you? ;P

✔ Mark as unread

Pablo Garaizar (over 3 years ago)

Congratulations!

Is not a good policy to accept every stranger as a friend.

Your second assignment as a social hacker will be a little bit harder. Try to become a friend of Bob Smith.

Hint: Sometimes making up your profile is a good way to look familiar ;)
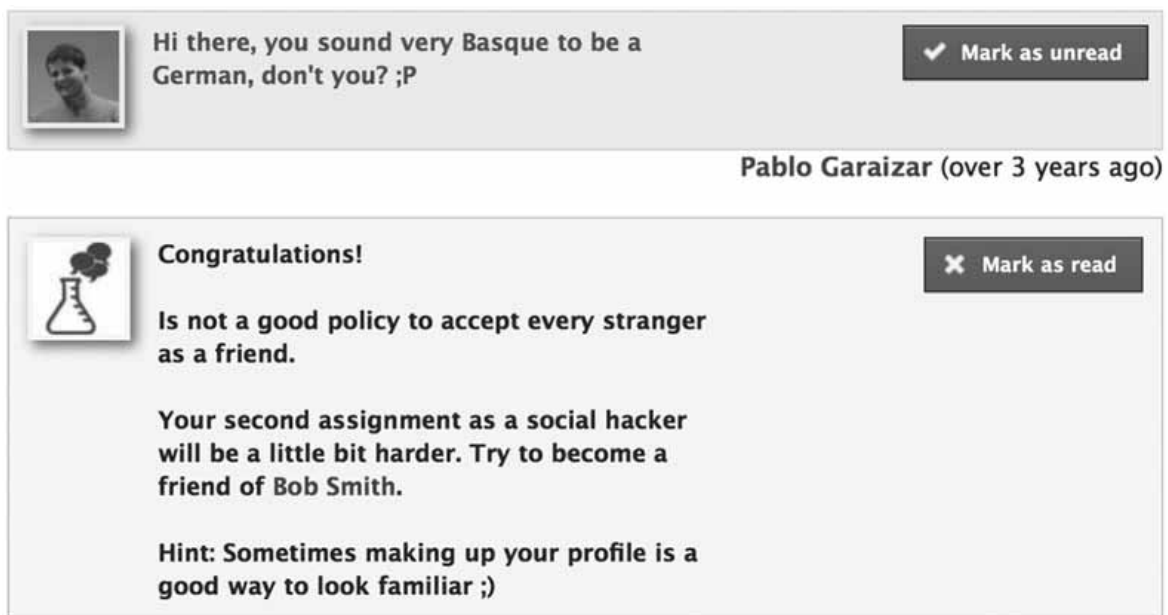
✖ Mark as read

Figure 29.6   Messages can be deployed by researchers or social bots or to provoke user actions

network condition. Participants were further randomly assigned to a node in their network, that is, the other participants they would see within the network were determined by this assignment. Further, each participant could receive at most one email from each of the participants they could see and they could not contact each other within the social network. Improving on this communication-poor, rather static and purely structural manipulation we could use the human-like bots available in Social Lab to, for example, influence risk perception in two initially structurally identical networks and observe risk communication, coping behaviour, and attitude change. In pre-study and follow-up surveys we could collect attitudinal information and self-reported behaviours and emotions from participants, and then see how these change depending on the experimental manipulations and resulting dynamics within the networks.

SETTING UP SOCIAL LAB AS AN EXPERIMENTAL ENVIRONMENT

Experiments can be conducted *within* a social network or *between* social networks. In the latter case, at least two structurally identical social networks need to be created using Social Lab after download and setup from www.sociallab.es. Participants should be recruited from different websites and in different modes (e.g. actively: 'push'; or passively: 'pull'). Via the multiple site entry technique (Reips, 2000, 2007), the researcher will be able to determine for each participant the site they were recruited from and will thus later be able to test for systematic differences between recruitment sites and modes. For example, we could aim for 2,000 participants (ca. 500 in each network), then have them fill in informed consent forms and randomly assign them to one of the four social networks. The social networks then need to be closed; no new applications would be accepted during the time of the studies.

Social Lab will often need to be adjusted to meet the requirements of a particular study. For example, there may be a need to limit configuration options (e.g. delete the informed consent option within Social Lab, if informed consent was already collected before the logon). We could also amend options to display 'news items' that can be used for experimental manipulations. As a way to manipulate exposure (e.g. via frequency and intensity of messages or via number of agents) and role modelling of coping strategies, several social bots can be created in all networks and their actions and timing programmed to serve the tasks

required by the experimental manipulations. For example, Gordillo et al. (2021) adapted Social Lab as an educational tool and assessed its potential to improve the digital competence of teachers in the area of safe and responsible use of technology in a MOOC (massive open online course).

OUTLOOK

We have presented the free open-source social network software Social Lab and outlined how it can be used in research. Social Lab provides most features that are common to social media and even additional ones: one of the most useful features in research is its automated programmable bots. We described how such social bots can be used in research and how to create and configure them within Social Lab.

Much research including social network analysis can be applied to social networks that are developed within Social Lab or manifest themselves in communications on this platform. With Social Lab, researchers can collect information on who is connected to whom and who communicates with whom, over time. Such data can then be used to investigate social network properties, such as density, clustering, and connectedness, or node properties, such as betweenness or centrality (see e.g. Brandes and Erlebach, 2005; D'Andrea et al., 2010).

We hope Social Lab will inspire many to set up free social networks for research and beyond. Apart from the thousands of users using it to learn about privacy in social networks, an open-source community has begun to form and help in its development. May the new tool help the scientific community to advance in the exciting study of behaviour in social media.

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