Experimental tribe: a general platform for web-gaming and social computation

Claudio Cicali
Institute for Scientific
Interchange (ISI),
Torino, Italy.
claudio.cicali@gmail.com

Pietro Gravino
Dipartimento di Fisica,
Sapienza Università di Roma, Roma, Italy.
Dipartimento di Fisica,
"Alma Mater Studiorum"
Università di Bologna, Bologna, Italy
pietro.gravino@gmail.com

Vittorio Loreto
Dipartimento di Fisica,
Sapienza Università di Roma, Roma, Italy.
Institute for Scientific Interchange (ISI),
Torino, Italy.
vittorio.loreto@roma1.infn.it

Gabriele Paolacci
Laboratory for Experimental
Economics and Department of Management,
Ca' Foscari University, Venezia, Italy
paolacci@unive.it

Vito D. P. Servedio
Dipartimento di Fisica,
Sapienza Università di Roma,
Roma, Italy.
vito.servedio@roma1.infn.it

Francesca Tria
Institute for Scientific Interchange (ISI),
Torino, Italy.
tria@isi.it

Massimo Warglien
Laboratory for Experimental
Economics and Department of Management,
Ca' Foscari University, Venezia, Italy
warglien@unive.it

Abstract

In the last few years the Web has been progressively acquiring the status of an infrastructure for "social computing" that allows to coordinate the cognitive abilities of human agents in online communities, and steer the collective user activity towards predefined goals. This general trend is also triggering the adoption of web-games as a very interesting laboratory to run experiments in the social-sciences and whenever the contribution of human beings is crucially required for research purposes. This paper introduces Experimental Tribe (ET), a novel general purpose web-based platform for social computation.

1 Introduction

The use of web-based games [1] for research purposes is a fast spreading phenomenon, changing the way research activities are conduced and how data are generated in many scientific fields. Two paradigmatic examples are *Foldit*[1] [2], a game in which players are challenged to guess the 3D

[1] fold.it

structure of a protein, and *Planet Hunters*[2] [3], by which participants can help in identifying new extra-solar planets using NASA data of star brightness.
The above mentioned projects have in common the involvement of individual volunteers or networks of volunteers, many of whom may have non specific scientific training, to perform or manage research related tasks in scientific projects. In this sense there are two examples of *citizen science* [4, 5, 6], i.e., a long-standing series of programs traditionally employing volunteer monitoring for natural resource management. In recent years, also thanks to the Web 2.0 explosion, citizen science projects are becoming increasingly focused on scientific research [7, 8] and amazing results have already been obtained. For example, the 3D structure of viral enzymes that challenged scientists for years has been discovered thanks to the efforts of Foldit players [9], and new candidate planets identified by Planet Hunters' players managed to survive data verification tests [3].
In a parallel development, the idea of *crowdsourcing* is at the heart of online labor markets such as Amazon Mechanical Turk (AMT), where a job is distributed by employers in small sub-tasks that workers can perform. Interestingly, AMT has proven to be useful also for scientific purposes [10, 11, 12], e.g. as a powerful tool for recruiting experimental subjects and facilitating their reward through monetary payoffs. Early experience with crowdsourced experiments has paved the way to the recognition that web experiments, even despite a partial control of the way participants are recruited and of the context in which tasks are executed, can be successfully used to study human collective behaviour and cognition. The blog `http://experimentalturk.wordpress.com/` presents an early review of existing replications on AMT of classic experiments on individual and interactive decision making, and provides first elements of validation of experimental practices in the web. [13].
AMT has also opened the door for exploration of processes that outsource computation to humans on a large scale. These human computation processes hold tremendous potential to solve a variety of problems in novel and interesting ways. Human ability to easily solve tasks which are difficult to solve by setting up efficient algorithms has been largely exploited for instance by Google in labeling images (through the ESP collaborative game [14]), language translators, etc. Although the tenets of human computing are being increasingly exploited, its use in the scientific community lacks of systematization. The realization of a single project often requires substantial effort and web-based experiments are still far from being standard research tools. The lack of tools that can greatly simplify and standardize the design of web games and experiments is a major bottleneck in the exploitation of such new research opportunities.
Despite its versatility [12] AMT has not been conceived as a platform for experiments. Experimentalists are left with the task of designing their own software solutions to manage interactions among participants and to build effective interfaces. Moreover, individual solutions to such problems often remain insulated with little or cumulative growth of tools and solutions. This is the reason why it is important to develop a versatile platform to implement social *games*. This is the aim of Experimental Tribe, the word game being intended as an interaction protocol among a few players implementing a specific task as well as a synonym of experiment on interactive behavior.

2 Experimental Tribe

Experimental Tribe (ET) is a platform for web-based experiments and social computation. It is currently available in beta version at `www.xtribe.eu`. ET is aimed at both gathering otherwise separate efforts to use web resources for scientific purposes and at providing the community with a tool to design experiments on the web, bypassing much of the "hard work". The benefit is twofold: on the one hand, it allows virtually any researcher to realize his own experiment with minimal effort, paving the way of the use of the web as a standard "laboratory" to perform experiments. On the other hand, it can be a strong "basin of attraction" for people willing to participate to experiments, making in this way recruitment much more easier than for single-experiment platforms.

As case-study experiments, two games are already implemented in the platform: *Nexicon* and *Blindate*. Nexicon is a collaborative word association game: two players, who cannot communicate with each other, have to write a set of words they associate with a given word (the same for both players). They win as soon as both of them write a common word. The scientific outcome of the game is the possibility of constructing a sort of perceptual network of word association, much along the same line of well known word association databases [15, 16]. Blindate, instead, is a collaborative game,

[2] `http://www.planethunters.org/`

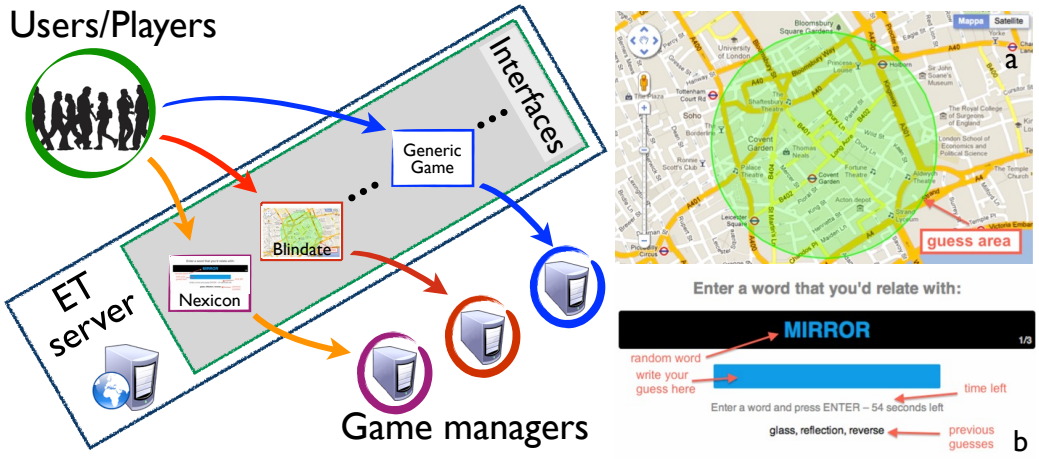

Figure 1: **Left** A graphical representation of the system and its interactions. Users/Players interact/play with one or more of the available games-experiments. Each game is conceived by the game managers who monitor the evolution through their local machines. The server handles players/users handling (registration and authentication), hosts the description pages and the interfaces of experiments and manages the actual instances of each experiment (creation, user grouping, error handling, feedback to users and manages, etc.). **Right** Two screenshots of the latest games uploaded on Experimental Tribe: (a) Blindate and (b) Nexicon (see text for details).

very close to the well known *Schelling's Games* first introduced in the early '60 [17]. In Schelling's original version (one of many similar problems), two players, unable to communicate with each other, were asked to find a point on a map where to meet, i.e. they had to find a strategically salient "focal point" among a potential infinity of solutions to the coordination problem. Since Schelling's seminal contribution, many versions of "Schelling games" have been used to investigate strategic salience, i.e. the individual ability to guess recursively what the other guesses that he will guess is salient, an so forth [18, 19]. In our custom version, two players are shown a portion of the map of a real city and are asked to point a location in a given area where they think it is more likely to meet each other. The reward is a score depending inversely on the distance between the guesses. In addition, after playing, participants may optionally explain with suitable tag words the reason of their choice. The purpose of the experiment is to get an annotated map of the focal points of the city.

3 Technical details

ET has been designed with a modular structure through which most of the complexity associated to running an experiment is hidden into a Main Server, while the experimentalist is left with the only duty of devising a suitable interface for the actual experiment. In this way most of the coding difficulties related to the realization of a dynamic web application are already taken care by the ET Server and the realization of an experiment should be as easy as constructing a webpage with the main utilities for it. There are different kinds of users for ET: the system administrator who runs the whole ET Server and provides all the necessary API's for it; the experimentalists who run individual experiments through ET; and the players who participate in one or more individual games.

Let us go in some details by keeping in mind as reference example the above mentioned game Blindate. The game can be imagined as a combination of two intercommunicating parts: the interface and the Game Manager (GM). The interface is what is visible to players, and in this example it would be a web page displaying the map. The interface will also interact with players, gathering their guesses on the map. The GM is represented by those functional parts that process the action of the players, e.g. in this case it calculates the distance between the guesses and assigns the score.
But even if the researcher writes down the code for both the interface and the GM, he is still far from the creation of a web game. Here, ET comes in handy. In first place, the ET platform will host the game interface. The platform will offer a page for the description of the game rules, compiled by the researcher, from which players can access and play the game. Instead, the GM part of the game

will be hosted by the researcher. In this way he can directly collect the data in real time.
Since the game has been created for research purposes, the researcher is interested in all sort of statistics related to players. Beside this, he may also be interested in filtering players for specific purposes, e.g. according to their age, gender, geographical location, nationality, etc. To this end, ET handles a user registry in which players will be allowed to register, if required, and play while the system would maintain all the information about them, such as scores, ranks, etc. together with biographical information. If needed, this information can be send to the GM, i.e. to the experimentalist. Furthermore, based on this information, when properly configured, the system will grant the access to the game only to certain profiles. Being in charge of the handling of the user registry, the system would also spare the researcher from dealing with privacy and security issues since all data will be properly anonymized and, possibly, encrypted.
Once the players have accessed the game, the system will create an instance of the game. There may be given rules for the game to start. A basic rule is the number of players. In particular, Blindate requires just two players, while in other cases there can be even one or more. There may be also different constraints. In Blindate, for example, the system can also pair players with similar scores or players playing from different geographical locations. As soon as there is a sufficient number of players satisfying the grouping constraints, the game starts. The interface will transmit the actions of the players to the GM, but all messages will pass through the system, which will group them by match instance number after having anonymized them. The GM will then receive the data, will elaborate them and will send the results of the elaboration back to the system, which in turn will transmit them to the interfaces. Obviously, it will also save the data of interest locally (the GM runs on the researcher's machine). The platform will also handle errors and exceptions. For instance, if the match aborts because one of the players disconnected, the system will detect it, will notify the abort to the remaining players (just one in Blindate) and will send a message to the GM. Since there is no direct communication between GM and interface, the GM will experience no trouble at all.
All these features, especially the user registry and the instance handling, usually require a lot of coding, quantified in time and money, to be realized. Within ET, they can be realized with a straightforward procedure. After the configuration, the system will automatically take care of all. What researchers have to do is writing the code of the interface and of the GM.
The interface has to be structured as a web page with plenty of freedom in using HTML, CSS, Flash, etc., while the interaction between the interface and the system has to be achieved by means of the ET API, which are internally developed as Javascript functions. With this simple set of functions the interface will interact with the platform and, through it, with the GM. Basically, the GM has to work as a HTTP server hosted on the researcher's machine. The communication with the system takes place through the HTTP protocol and all messages are coded in JSON format. Besides a restricted set of system messages, the game internal protocol is fully elaborated by the researcher.

4 Further developments

To summarize, ET handles all the aspects of the realization of web experiments that does not concern directly the game itself, thus allowing the researcher to focus only on the core of the experiment, leaving the rest to the system. In Fig. 1 we reported a graphical representation of the task splitting between the researcher and the server.

The ultimate aim of the project is to allow researchers working in different fields, who lack computer science expertise, to create web-based experiments and games. In order to achieve this goal, the first step is to create a set of "default" GMs for games corresponding to the most standard types of web experiment, such as surveys or coordination games. At the moment, the only "default" GM available in the platform simply broadcasts to all the players the message received from each one. The following step will be the realization of a set of graphical tools to create the simple interfaces, in order to make it possible to set up a web experiment without writing a single line of code.

In the long term, the platform will also come in help when dealing with another typical issue of web experiments: the recruiting. It is often quite difficult to gather a critical mass of "suitable" players, but since the game is hosted on the platform, and will be shown on its main page, other players already involved in other games would probably join. We expect a community of players to gather on the platform playing different games and also giving researchers feedback about their experiments. We also expect researchers to spontaneously aggregate into communities, sharing advices and best experimental practices with each other.

Acknowledgments

We acknowledge the EveryAware european project nr. 265432 under FP7-ICT-2009-C for financial support.

References

[1] von Ahn, L (2006) Games with a purpose. *Computer* 39:92–94.

[2] Cooper, S et al. (2010) Predicting protein structures with a multiplayer online game. *Nature* 466:756–760.

[3] D. Fischer, ea (2011) Planet Hunters: The First Two Planet Candidates Identified by the Public using the Kepler Public Archive Data. *arXiv:1109.4621v3*.

[4] Arnstein, S (1969) A ladder of citizen participation. *JAIP* 35:216–224.

[5] Goodchild, MF (2007) Citizens as Voluntary Sensors: Spatial Data Infrastructure in the World of Web 2.0. *International Journal of Spatial Data Infrastructures Research* 2:24–32.

[6] Paulos, E, Honicky, R, Hooker, B (2009) in *Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City*, ed Foth, M (IGI Global), pp 414–433.

[7] Nosek, BA, Banaji, MR, Greenwald, AG (2002) E-research: Ethics, security, design, and control in psychological research on the internet. *Journal of Social Issues* 58:161.

[8] Salganik, MJ, Watts, DJ (2009) Web-Based Experiments for the Study of Collective Social Dynamics in Cultural Markets. *Topics in Cognitive Science* 1:439–468.

[9] F. Khatib, ea (2011) Crystal structure of a monomeric retroviral protease solved by protein folding game players. *Nat Struct Mol Biol*.

[10] Chilton, LB, Sims, CT, Goldman, M, Little, G, Miller, RC (2009) *Seaweed: a web application for designing economic games*, HCOMP '09 (ACM, New York, NY, USA), pp 34–35.

[11] Mason, W, Watts, DJ (2009) *Financial incentives and the performance of crowds*.

[12] G. Paolacci, JC, Ipeirotis, P (2010) Running Experiments on Amazon Mechanical Turk. *Judgment and Decision Making* 5:411–419.

[13] Suri, S, Watts, DJ (2010) Cooperation and Contagion in Networked Public Goods Experiments. *Computing Research Repository (CORR)*.

[14] von Ahn, L, Dabbish, L (2004) *Labeling images with a computer game* (ACM, New York, NY, USA), pp 319–326.

[15] Nelson, D, McEvoy, C, Schreiber, T (2004) The university of south florida free association, rhyme, and word fragment norms. *Behavior Research Methods* 36:402–407 10.3758/BF03195588.

[16] Gravino, P, Servedio, V, Barrat, A, Loreto, V (2011) Complex structures and semantics in free word association. *Advances in Complex Systems*.

[17] Schelling, T (1960) *The strategy of conflict* (Harvard UP, Cambridge, Mass.).

[18] J., M, C., S, R., S (1994) The nature of salience: An experimental investigation of pure coordination games. *Am.Ec.Rev.* pp 658–673.

[19] Crawford, V, Gneezy, U, Rottenstreich, Y (2007) The power of focal points is limited: Even minute payoff asymmetry may yield large coordination failures. Am.Ec.Rev. pp 1443–1458.