Opinion Elicitation in Second Life

Marijn van Vliet[1,2], Alena Neviarouskaya[3], and Helmut Prendinger[1]

[1] National Institute of Informatics, Japan
helmut@nii.ac.jp
[2] University of Twente, Department of Human Machine Interaction, The Netherlands
w.m.vanvliet@student.utwente.nl
[3] University of Tokyo, Department of Information and Communication Engineering, Japan
lena@mi.ci.i.u-tokyo.ac.jp

Abstract. The paper describes a novel method for opinion elicitation, which is based on the popular 3D online world of "Second Life". Here people, as avatars, are put into a somewhat realistic context related to the topic for which opinions are sought. We hypothesize that this kind of concrete, interactive context supports the evocation of opinions better than non-context methods, e.g. only showing related images. To confirm our hypothesis, we conducted a small pilot study, which compares the influence of static and interactive context methods on the opinions expressed by subjects. The opinion elicitation scenario in Second Life is supported by the automatic retrieval of opinions from the web. The results of a study indicate that subjects show more reasoned opinions in the interactive condition. A demo illustrating the content of this paper is available.

Keywords: Opinion elicitation, virtual worlds, avatars, subjectivity analysis.

1 Introduction

Testing new laws or policies in the real world is costly and risky. Usually, new laws are first investigated in laboratory settings, where their effects on people are observed, and assessed by questionnaires. However, there is often a gap between laboratory conditions and the experience in a real-world setting. Therefore, two lawyers [1] suggested to first test new regulations in a virtual world, before commencing real-world implementation.

We adopted a variant of this approach in order to investigate opinions about genetically modified tomatoes. Specifically, the virtual world setting is employed to assess people's attitude towards a somewhat controversial topic, like genetically modified food. As the virtual world, we chose Second Life, a three-dimensional (3D) networked environment (www.secondlife.com), which is based on user-generated content rather than a pre-defined game plot. Here, we created small (virtual) fields with natural and genetically modified tomatoes. In order to evoke the opinions of users, who are represented as avatars (graphical self-representations) in Second Life,

A. Nijholt, D. Reidsma, and H. Hondorp (Eds.): INTETAIN 2009, LNICST 9, pp. 252–257, 2009.

computer-controlled agents (bots) were designed and 'fed' with opinions derived from web sources using the developed (simple) opinion mining system.

2 Opinion Extraction from the Web

The document collector is a program that automatically crawls for information from the web. It takes as input a set of keywords from the user, queries several search engines with the keywords and parses the results to a data structure.

Unlike other crawlers, it tries to extract metadata from the retrieved documents, like the publication date, the name of the author and an article–comment hierarchy. This is accomplished by parsing the HTML with manually created XSL templates, which results in a list of articles, associated comments and possibly new URLs that will be crawled next. The XSL templates will remove all HTML markups, leaving the data in a polished format ready to be processed by natural language systems.

The result of the document collector is a database with articles and comments. The next step in the process is to extract single sentences from this data, which are expected to be useful for provoking the users' to express their opinion. In this research, we concentrate on extracting subjective sentences that directly relate to the topic. To accomplish this, the OpinionFinder system [4] has been used in combination with a method described in [2].

Each article and each comment is parsed with OpinionFinder. The output of the system is an annotated version of the text. For each sentence, a subjectivity score is given. The subjectivity score consists of a flag indicating the sentence as objective or subjective and a number indicating the confidence of the classifier. The higher the subjectivity score, the more confident the OpinionFinder result.

Any sentences classified as being subjective are extracted and passed to the next step, where the query originally entered by the user is used. For each subjective sentence provided by the previous step, any words which correspond to a word in the query are marked as keywords. For example, for the query "genetically modified tomatoes" we obtained (among others) the sentence: *"*I *dislike unnatural* food, genetically modified food is *rubbish* and *unnatural*, do you know genetically modified tomatoes can cause genetic *disorder*?*"* It was given a subjectivity score of 32.0. The subjectivity hints are set *in italics* and the keywords are underlined.

For each word that was marked as a subjectivity hint in the sentence by the OpinionFinder system, the distance to the nearest keyword is calculated, resulting in a set of distances. The distance to a keyword is a measure for the probability of a semantic relation between the two. The exact probabilities for adjectives are calculated in [2]. In our work, subjectivity hints are restricted to adjectives (as marked by the POS tagger of the OpinionFinder system).

For the previous example sentence, the following {subjectivity hint, keyword} pairs would be identified: *{unnatural, genetically}, {rubbish, modified}, {unnatural, genetically}*. The corresponding distances are {2,-3,4} and the associated probabilities are {0.1504, 0.0585, 0.0141}.

The sum of the calculated probabilities is stored as the 'filter score'. The higher the filter score, the more likely it is that the opinion is about the topic the user was

searching for. If the subjectivity score of a sentence is over a certain threshold and the filter score is more than zero, the sentence is classified as containing a relevant opinion. Such sentences, sorted by their filter score and additionally annotated by polarity (positive or negative), are included in the final relevant data set.

3 Pilot Study

The goal of the pilot study was to investigate the impact of the virtual environment on the way users formulate their opinion. Two types of virtual environments were created. One environment is 'static', showing pictures of genetically modified and natural tomatoes. The other one is 'interactive' (or immersive), allowing participants to visit a virtual field, and perform some (limited) interaction with the environment. The interview was conducted by computer-controlled agents, which stimulated the expression of subjects' opinions by first telling their 'quasi-own' opinion (extracted from web sources) regarding genetically modified food.

The main hypothesis is: *When placed in a virtual environment, which exemplifies the given topic of the opinion target, a user will express more reasoned opinions when the environment is interactive, as opposed to a static environment with only images.*

The hypothesis states that when a person is asked about his or her opinion by an automated system, the context, i.e. local environment in which the person is situated in, has an impact on the resulting opinion. In our case, the opinion target is genetic modification and in particular the genetic modification of tomatoes.

An environment consisting of just text and pictures describing genetically modified food is considered as 'static' (non-context control condition). On the other hand, a rich 3D environment with a tomato field where tomatoes can be picked and examined more closely is considered 'interactive' (the context experimental condition). The hypothesis states that in the latter environment, the opinions of the users will be more elaborate, because they are 'grounded' in a realistic (albeit virtual) experience.

3.1 Experimental Design

The verbal and non-verbal behavior of the computer-controlled agents (telling and asking for opinions) was driven by MPML3D, which is an authoring language for virtual agents. The agents use a text-to-speech system (Loquendo), whereby the utterances are also written into the standard chat channel of Second Life, effectively providing subtitles. Subjects respond to the agents by using the same chat functionality. We used a between-subjects design and created two scenarios.

- *Static (non-context) condition*: Two computer-controlled agents (bots) tell preselected opinions about genetically modified (GM) tomatoes to subjects, and poll them for their opinion. There are pictures of both GM and natural tomatoes.
- *Interactive (context) condition*: The same computer controlled agents do the same as in the static condition. Instead of pictures, there are virtual fields with both GM and natural tomatoes, which the users can pick and examine.

Figure 1 shows screenshots of both environments.

Fig. 1. Top: static environment. Bottom: interactive environment.

3.2 Subjects and Procedure

In total 10 subjects (7 male, 3 female), with an average age of 24 (std-dev 2) participated in the study. They were randomly split into two groups of 5. The subjects were all students from the Netherlands (while the conductor was in Japan). Subjects were paid 500 Linden Dollars, the official currency of Second Life, for their efforts.

Subjects' avatars visited the specified location in our Second Life environment individually. The experimental conductor asks if the subject has any questions. Then the conductor informs that the experiment will start, and his avatar (i.e. the avatar of the first author of this paper) will disappear from sight.

In the static condition, the subject will look at three pictures (about the tomatoes) and approach the two bots when finished. In the interactive condition, the subject is instructed to select five natural and five GM tomatoes from the virtual field by clicking on them. The selected tomatoes will appear in the basket.

Subsequently, in both conditions, the subject will *first* hear an opinion promoting genetic modification, presented by a male bot. Having said its opinion, the bot will use a trigger sentence like "What do you think?" to enquire about the opinion of the

subject. The subject will give his or her opinion using the local chat functionality. *Next*, the subject hears an opinion contra genetic modification, spoken by a female bot. Likewise, the bot will try to trigger a response from the subject. This process was repeated five times. Finally, the bots will thank the subject for his or her cooperation and direct the user to a website with a questionnaire.

Examples of pro/contra opinions presented to the subjects include:

- "Genetically modified food may increase the world's crop by having stronger genes and a longer preservative time." (Pro)
- "I dislike unnatural food. Genetically modified food is rubbish and unnatural. Did you know genetically modified tomatoes could cause genetic disorder?" (Contra)

The presented utterances were manually selected from a list of automatically collected opinions in order to increase the controllability of the experiment. Each subject was presented with the same opinions as the others.

3.3 Results

The responses made by the subjects were analyzed using our new SVM-based discourse parser (http://nlp.prendingerlab.net/hilda/). The parser identifies 19 distinctive rhetorical relations between units of sentences. Relations were divided into two classes: 'specific' relations (often) indicate some underlying argumentation within responses whereas 'generic' relations (often) relate two or more sentences. The results presented in Table 1 seem to support our hypothesis, that the interactive environment triggers more reasoned opinions in people.

Table 1. Rhetoric relations in the responses by eight subjects (one excessively verbose subject in the static version was omitted, and one subject in the interactive version, because of a system error towards the end of the session)

Type of relation		Interactive env.		Static env.	
		Number	**Percentage**	**Number**	**Percentage**
Specific	Contrast	14	13.86	6	6.06
	Condition	5	4.95	3	3.03
	Comparison	3	2.97	1	1.01
	Explanation	2	1.98	1	1.01
	Manner-Means	1	1.01	0	0.00
	Enablement	0	0.00	1	1.01
	Total	14	13.86	7	7.07
Generic	Elaboration	38	37.62	46	46.46
	Attribution	29	28.71	23	23.23
	same-unit	5	4.95	3	3.03
	Joint	3	2.97	9	9.09
	Temporal	1	0.99	1	1.01
	Background	1	0.99	4	4.04
	Total	39	38.61	50	50.51

After the experiment, the subjects answered a short questionnaire, with four questions regarding *fun*, *impact of the environment*, *impact of the bots* and *task difficulty*. A 7-point Likert scale was used: 1 for "completely disagree" and 7 for "completely agree". The collected data shows mostly consensus between both conditions. However, the difficulty dimension ("It was difficult to give my opinion") indicates that users might feel more comfortable in the interactive environment (an average score of 2.6 for the interactive vs. 4.2 for the static). We can only speculate that the easiness of opinion expression can be attributed to the interactive, immersive nature of the environment.

4 Conclusions

In this paper, we show how virtual worlds like Second Life can serve as a platform for contextualized opinion elicitation, and in a further step, support e-rulemaking. We describe our first study, which involves the evocation of opinions in the field of genetically modified food. Opinions were automatically retrieved from the web through a simple, but effective process, and fed into Second Life bots, who presented the opinions to visitors. Keeping in mind that we conducted a pilot study, the main result is that in the condition which exploits the power of a virtual environment (e.g. interaction with virtual tomatoes), subjects showed more argumentation patterns in their responses. We take this as a non-trivial promising outcome, which will still have to be confirmed by a larger-scale study.

Acknowledgements

The first author was supported by an NII Grand Challenge project grant. We would like to thank Hugo Hernault for helping with the discourse parser.

References

1. Bradley, C., Froomkin, M.: Virtual Worlds, Real Rules. In: Law Review, pp. 103–146. New York Law School, New York (2004)
2. Skomorowski, J., Vechtomova, O.: Ad Hoc Retrieval of Documents with Topical Opinion. In: Amati, G., Carpineto, C., Romano, G. (eds.) ECIR 2007. LNCS, vol. 4425, pp. 405–417. Springer, Heidelberg (2007)
3. Ullrich, S., Prendinger, H., Ishizuka, M.: MPML3D: Agent Authoring Language for Virtual Worlds. In: Proceedings International Conference on Advances in Computer Entertainment, pp. 134–137. ACM Press, Yokohama (2008)
4. Wilson, T., Hoffmann, P., Somasundaran, S., Kessler, J., Wiebe, J., Choi, Y., Cardie, C., Riloff, E., Patwardhan, S.: OpinionFinder: A System for Subjectivity Analysis. In: Proceedings of HLT/EMNLP 2005 Interactive Demonstrations, Vancouver, British Columbia, Canada, October, ACL, pp. 34–35 (2005)