E-Social Science Perspective on Survey Process: Towards an Integrated Web Questionnaire Development Platform

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This article was originally published in publication Engel, U., Jann, B., Lynn, P., Scherpenzeel, A. and Sturgis, P. (eds.) Improving survey methods. New York; London: Routledge, 2015. ISBN 978-0-415-81762-2.

Suggested citation:
Vehovar, V., Petrovčič, A. and Slavec, A. (2015). E-social science perspective on survey process: towards an integrated web questionnaire development platform. In Engel, U., Jann, B., Lynn, P., Scherpenzeel, A. and Sturgis, P. (eds.), *Improving survey methods* (170-183). New York; London: Routledge. Doi: 10.4324/9781315756288

1. E-Social Sciences Context

Survey research literature predominantly focuses on methodological issues, such as survey errors and survey modes, related to the fielding activities of the survey data-collection process. Much less attention is given to the broader administrative, managerial, infrastructural and process-integration aspects of pre-fielding (i.e., planning, conceptualization, questionnaire development, testing) and post-fielding (i.e., data preparation, automated analysis, archiving, dissemination, publication). There is also a serious lack of attention to the integrative potential of information-communication technology (ICT) for the survey process, at least in the mainstream of the vast majority of tools that support the survey process. This issue is only dealt at large survey-data organisations (see for example the special issue of *The Journal of Official Statistics* (e.g., Biemer et al. 2013)), which, however, are not the focus here.

With the rise of the internet, the interaction between modern society and ICT has in general moved to a new level, and is addressed in various contexts from social informatics (Kling, Rosenbaum & Sawyer, 2005) to Science, Technology and Society (STS) studies (Hackett, Amsterdamska, Lynch, & Wajcman, 2007). The notion of *e-social science* also appears here, referring to digital communication, collaboration and computational tools in the social-science research process. ICT increasingly integrates research stages and provides potential gains in

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resources, time and quality (Dutton & Jeffreys, 2010; Jankowski, 2007; 2009a; Schroeder & Fry, 2007; Searight, Mauldin, Ratwik, Conboy & Searight, 2011), which also matches the requests from funders and academic authorities.

However, some initial applications of the e-social science concept (Jankowski, 2009b; Dutton & Jeffreys, 2010; Schroeder & Fry, 2007) also suggest that a broader framework is needed to accommodate the increasingly complex transformation of empirical social-science research supported by online research tools and methods (Jankowski 2009a). Hence, the study of the technological affordances of ICTs that support social scientists needs to be accompanied by a conceptual and empirical reflection on how researchers react and actively participate in the undergoing technological transformation of their work environment (Meyer & Dutton, 2009). Within this context, relatively little systematic knowledge is available about internet-based tools that would support the online collaboration and data-collection phases of a research project within an integrated platform (Jankowski, 2009a). In fact, the existing e-social sciences literature observes that tools that are designed for online collaboration and communication among social scientists are generally not fully integrated into ICT-based solutions that support other phases of the (empirical) social-science research process. On one hand, this condition might stem from the heterogeneity of scientific communities and disciplines in social sciences (Dutton & Meyer, 2009). On the other hand, the socio-technical design of existing (non-integrated) software solutions further stimulates the separation of the research process (Macer & Wilson, 2011).

We argue here that conceptual barriers often maintain the disintegration of the research processes, despite the fact that the technical potential of ICT is already developed enough to allow for more integration. With reference to web-survey software tools, this issue can be seen in their late integration with various Web 2.0 solutions, so that platforms conceived in the late 1990s with relatively limited (as of 2012) support for Web 2.0 features still dominate the market (e.g., SurveyMonkey, LimeSurvey, Blaise). Another typical example of such a lack of integration is the fact that initial versions of survey questionnaires are still predominantly designed using word processors (e.g., MS Word, Google Docs) and communicated with simple email exchange. Only when a draft becomes mature or even final is it converted into a computerized form. As suggested by Macer and Wilson (2011), such fragmented ICT-based support neglects the needs of researchers, who prefer integration.

Within this context, we deal here with a specific case of web-questionnaire development, which illustrates well the above-mentioned barriers. First, we illustrate current practice (2). Next, we show the gains of a conceptually integrative approach (3). With such an approach, many barriers can be removed even with relatively primitive technical solutions. Finally, in the conclusion (4), we discuss the findings and identify potential directions for future research.

2. Web-Questionnaire Development: An Illustration of Current Practice

The core of ICT integrative support for the survey research process has been related to Computer Assisted Survey Information Collection (CASIC), which links the corresponding data collection stages (Vehovar & Lozar Manfreda, 2008). The notion of CASIC had already emerged in the 1980s with computer-assisted telephone interviewing (CATI); then it gathered momentum in the 1990s with the emergence of the internet; and now it has blossomed in numerous directions, from web and mobile research to virtual interviewers. However, despite these advancements, CASIC still kept its focus on the fielding stage, with a certain shift towards *CASIC-specific* survey modes, while the integrative role of ICT was still missing from corresponding ICT (i.e., CASIC) platforms. The modern web-survey tools thus predominantly still support only the core data-collection process (i.e., fielding stage), while other stages are generally not integrated (Kaczmirek, 2008; Macer & Wilson, 2012; Vehovar, Čehovin, Kavčič & Lenar, 2012). The only exceptions are a few of the most complex tools and case-specific projects in some large-survey data-collection organisations.

The development of a survey questionnaire provides a very suitable illustration of the above assertion. Specifically, many researchers and corresponding clients may have already experienced how non-integrated, sometimes cumbersome and even painful (e.g., lost comments, wrong versions), it can be to comment on questionnaire versions in word processors (e.g., MS Word, Google Docs) and exchange them via email or web.

Here, we present a typical situation in the questionnaire-development process related to the 7EU-VET project (2010–2012)[2] with a survey in seven EU countries, using a 30-minute self-

[2] Detailed Methodological Approach to Understanding the VET Education, http://www.7eu-vet.org

administered questionnaire (both paper-and-pencil and web) among students in the vocational education system.

The initial conceptualization of the topics was done from March to June, 2010 at a partner meeting and via email correspondence, followed by initial word-processor[3] versions of the questionnaire:

- First, second and third internal outlines, July, August, 2010
- Fourth, fifth and sixth internal drafts, September, 2010
- Seventh, eighth and ninth draft versions for partners' feedback, September, 2010.

The word processor also served as a communication platform since comments were written with the track-changes function enabled (shown as the coloured input, directly in the text) and further discussed with the corresponding commenting functions (Figure 1).[4] The marked-up version was then distributed via email to project partners. After the ninth version, the questionnaire was turned into an online form in October, 2010 as the first online version, followed – after online commenting – by the second online version. The latter was then exported again into a word processor, where the tenth, eleventh and twelfth versions were further commented on (due to complexity, some contributors believed that the issues would be dealt with better by commenting offline than online). However, this time the corrections were inputted into the online version,[5] which was exported again into a word processor for further comments. After the twelfth offline (word processor) version – exported from corresponding online versions (not explicitly numbered here) – the third, fourth, fifth, sixth, seventh and eighth online versions were exposed only to the online commenting system. The ninth computerized version was then accepted as the final draft ready for English proofreading in November, 2010.

This was then further followed by translations and back-translations, resulting in additional comments and versions. The same was true for the final activities of proofreading, field testing and laying-out of the design, which resulted in several more versions until January, 2011, when the final versions in all languages were concluded.

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[3] MS WORD was used for word processing.
[4] Comments were placed to the right of the body of the text (MS WORD command: Review→New comment).
[5] One of the most comprehensive tools was used, providing an advanced online commenting system (still a rather rare functionality in these tools), i.e. GlobalPark EFS, acquired later by QuestBack.

In a comparative research framework and with the given complexity, this questionnaire-development process was perhaps neither excessively lengthy nor complex. However, we suggest it would benefit from a more integrated ICT support, which would, among other benefits, avoid switches between the word-processor and computerized versions.

As a matter of fact, very often in reality even many more changes and much more commenting can be found than is seen in Figure 1, resulting in cumbersome and colourful screens on which it is increasingly difficult for researchers to provide further comments and to trace the current status of a particular comment (i.e., whether it is solved, rejected or still in process).

Figure 1: A screen from a word-processor version of a draft questionnaire in the 7EU-VET project

3. Integrated Support for Questionnaire Development: An Experiment

We argue that the above-illustrated fragmentation of ICT integration, which might seem to be a technical problem, is actually a conceptual one. The implementation of e-social sciences would conceptually mean that ICT integrates – as much as possible – all sub-stages of the questionnaire-development process within one single tool. Of course, questionnaire development is only one specific aspect of the survey process, while the integration of the entire survey research process (i.e., pre-fielding, fielding and post-fielding) is much more complex. However, conceptually there is not much difference, so we will continue with this example, showing that technical obstacles can be overcome relatively easily (even with a relatively primitive pilot tool) once a conceptual breakthrough occurs. By "conceptual breakthrough," we mean here starting to think about the survey process (and corresponding ICT support) as one entity and not as a composite of separated steps. The latter way of thinking is often reinforced with the tools which were conceptualised and designed by computer personnel and not by survey methodologists.

The ICT integration of the questionnaire-development process would basically require abandoning the word processor and exchanging questionnaires by email. To achieve this, the alternative online tool must include two essential functionalities, the absence of which is nowadays (still) forcing researchers to rely on word processors when developing (early) drafts of the questionnaires. First, *direct inline editing* is needed to replace the usual practice in web-survey software tools, which is first opening the question, followed by editing and concluding with another step of saving the changes. Instead, users should have a user-friendly option allowing them to move the cursor to a desired location, click there and edit the question immediately (without any opening or saving the question). Second, a *drag/drop* or *cut/paste* command for questions must enable moving questions with a mouse or other pointing device, which is a standard Web 2.0 feature. Even though these seem like trivial solutions in terms of technical implementation, a recent study shows that out of the 15 most popular software tools, only one enables inline editing, while only four have drag/drop functions (Vehovar, Slavec, & Berzelak, 2011).

Of course, in addition to these two essential components, the online integrated tool should also provide all standard features of modern web-survey software tools. A very important option is the collapsed view (i.e., seeing one line per question), which simplifies editing the questionnaire structure (e.g., question orders, conditions, blocks). Moreover, an internal (for editors) and external (for respondents) commenting system needs to be incorporated, as well

as the functionalities of copying, versioning and archiving of the questionnaire. A recent update of web-survey software tools (Vehovar et al., 2013) showed relatively little progress with respect to these issues. The tools may increasingly support these features, but we could not find the corresponding integration.

In order to carry out the herein presented experiment, we developed and used a prototype of an academic research tool with all standard industry functionalities,[6] and we extended it with the above-mentioned inline editing and drag/drop options so that the entire process of questionnaire development could run without word processors and email exchange.

Our hypothesis was that the integrated online tool would outperform the standard procedure (relying on word processor and email exchange) in time, quality and user satisfaction.

3.1 Methodology

The experiment was performed with 16 graduate students in the Research Methods course at the Faculty of Social Sciences of the University of Ljubljana in 2011. Half of them were foreign students[7] and the other half were local ones. They all had some experience with survey methodology and statistics. Four groups were formed randomly (with each having two international students) and each group worked both on developing a questionnaire in online mode, using the prototype tool (experimental group), and on developing another questionnaire in offline mode, using the standard approach with word processors and email communication (control group). Thus, eight distinctive questionnaires were developed, two by each group.

All groups had to work on two topics that we defined in advance – one was related to attitudes towards wild animals kept as domestic pets, while the other dealt with sports activities of foreign students at the University. Groups 1 and 3 worked on the animal topic as the experimental group (online mode), while groups 2 and 4 were assigned this topic as control groups (offline mode), and vice versa for the sports topic: groups 1 and 3 were the control group (offline) and 2 and 4 the experimental (online). So each group worked on two projects, but – due to experimental design – with both topics and both modes.

[6] 1KA (http://1ka.si). Extensive user evaluations and comparisons with popular web-survey tools showed that for academic purposes 1KA performs similarly.
[7] Students were part of an EU Erasmus exchange.

Students were assigned four roles: online editor, offline editor, tester and evaluator. The editors were responsible for questionnaire development, handling comments, moderating discussions, archiving versions, spell-checking, etc. One editor in the group was assigned to the offline development, the other to the online one. The third role was that of the tester, responsible for all testing issues. The fourth member was the evaluator, whose task was to write evaluations of all activities, detecting problems, monitoring timing, etc. In addition, the evaluator helped with the testing of the questionnaire (administering a live test with participants). All four members were required to contribute ideas and comments to both questionnaires. Other duties also existed (e.g., data collection, analysis, report writing) but were not relevant for this study.

In the offline mode of questionnaire preparation only email exchange was allowed, while for the online mode only communication through the prototype tool was allowed. Everybody was obliged to respond to requests promptly and to accomplish tasks within the allotted time. All time spent on various tasks was meticulously reported on time sheets.

3.2 Procedure

The experiment lasted six weeks. During the first week each student reviewed relevant substantive sources for both topics and prepared a brief with ideas. Then the students met and discussed the briefs, and the editors started with the questionnaires.

In the second week, online editors prepared their questionnaire outlines (Version 0) using the online prototype tool, while offline editors prepared them as MS Word documents. In total, there were eight versions, two for each group, four for each topic and four for each mode (Table 1). The feedback for the online version was submitted through a special commenting functionality of the prototype tool, while for the offline version it was created in the word processor and sent by email. The editors reviewed the comments and then prepared the draft versions of the questionnaires (Version 1).

In the third week the evaluators systematically checked the questionnaires according to formal design guidelines in the course literature and prepared a report for the respective editors. In parallel, the two other members of the group made the second wave of internal comments.

The next draft of the questionnaire (Version 2) was then created, and testers prepared a proposal for the testing procedure.

In the fourth week the tester performed quantitative testing on a small sample of respondents, while the evaluator performed qualitative interviews (one for each topic) using the think-aloud method. In the online mode, quantitative testing was done via the prototype tool using online comments, while in the offline mode the word-processor version was sent to the respondents with the request to provide written comments and email them back as soon as possible. The respective editors then prepared another draft (Version 3).

In the fifth week, the Versions 3 of the offline questionnaire were entered in the online tool[8] (Version 3b) and from this point on – in this mode too – the questionnaire was developed exclusively online, except for the comments, which were still exchanged via email. Next, another wave of internal feedback exchange was conducted in both modes. In response to this feedback, editors had to come up with the new draft questionnaire (Version 4).

In the sixth week Version 4 was evaluated by three external experts. In addition, the evaluators reviewed the questionnaires according to the Statistics Sweden Checklist.[9] The questionnaire (Version 5) was finalized by the end of the sixth week. The four animal questionnaires were 36 to 66 response items long (depending on how ambitious and motivated the group members were), while the sports questionnaires had 22 to 32 response items. All eight questionnaires were somewhat complex and included a lot of conditioning and branching.

3.3 Results

We used time sheets and the final evaluation survey to summarize key findings (Table 1). Three out of the four groups needed more time (i.e., the number of hours recorded on the time sheets) to finalize the questionnaire (Version 5) in the offline mode. Overall the difference in means was 34 hours 36 minutes (online) and 37 hours 30 minutes (offline). However, with

[8] The same web-survey software tool (1KA), however, without the usage of the commenting system.
[9] http://www.scb.se/statistik/_publikationer/OV9999_2004A01_BR_X97OP0402.pdf

only four groups with two measurements the specific ANOVA statistical test did not show statistically significant differences.

Similarly, the overall quality – measured by the self-evaluation question *"How would you rate the quality of your groups' animal/sports questionnaire? 1 – Poor, 2 – Fair, 3 – Average, 4 – Good, 5 – Excellent"* – was higher for online modes within all groups, the largest span between the experimental (online) and control (offline) group being for Group 4 (3.3 offline and 4.0 online). Nevertheless, the repeated results from ANOVA again showed no statistical significance. Of course, the difference could be partly due to the interaction with the questionnaire topic, and controlling for it we see that the difference between the offline and online group is quite obvious within the animal questionnaires (3.0–3.3 offline; 4.3–4.5 online) and within the sports questionnaires (3.7–4.0 offline; 3.3–4.0 online). Here, on the other hand, it is important to note that the questionnaires varied among groups due to personal characteristics of group members that we were not able to control. The higher satisfaction of the G1 group with the off-line sports questionnaire than the G2 group with the corresponding online version (Table 1) can be explained by group characteristics (G1 was generally very satisfied, while G2 had lower general satisfaction).

Table 1: Quantitative evaluation results

Topic	Offline			Online		
	Group	Time	Evaluation	Group	Time	Evaluation
Animals	G2	42 h 30 min	3.0	G1	38 h 30 min	4.3
	G4	38 h 30 min	3.3	G3	36 h 00 min	4.5
Sports	G1	28 h 30 min	3.7	G2	32 h 00 min	3.3
	G3	41 h 00 min	4.0	G4	32 h 00 min	4.0

While the above result may not be very persuasive, more evidence in favour of the integrated online version arises from the comparisons of individual student evaluations (Table 2). Results show that all but one student (in Group 2: 2 online, 3 offline) rated the online questionnaire as at least as good as the offline or better. A paired sample t-test indicates significant differences ($p<0.05$); however, accepting this result would require us to assume

that the animal and sports questionnaires (within groups) are equivalent (or at least very similar in characteristics), which might be questionable.

Table 2: Quantitative evaluation results

Group	Online q.	Offline q.	Average online	Average Offline
1	5	5	4.3	3.7
1	4	3		
1	4	3		
1	-	-		
3	4	4	4.5	4.0
3	4	3		
3	5	5		
3	5	4		
2	4	3	3.3	3.0
2	2	3		
2	4	3		
2	-	-		
4	4	3	4.0	3.3
4	4	3		
4	4	3		
4	4	4		

Note: Group 1 and 3 prepared the animal survey online and the sports survey offline, while Group 2 and 4 did the reverse. Two students did not respond to the evaluation.

Furthermore, user satisfaction was measured by posing the following question *"If you were to develop a questionnaire with a group of colleagues, which method would you choose? Online definitely, online preferably, offline preferably, offline definitely?"* Half responded with

online definitely and the other half with *online preferably*. No student chose *offline preferably* or *offline definitely*, despite some technical difficulties with and shortcomings of the online prototype tool. This result very clearly demonstrates the advantage of the online version, which was – due to small sample sizes – only weakly shown in previous tables. It should be noted, however, that students are not experts, and they belong to the generation that is more favourable to online procedures. A study on a different population could show completely opposite results.

In addition, students provided extensive open comments, confirming the above findings uniformly favouring the online version. They also provided many specific comments on methodological and technical details. On one hand, the most-often-mentioned advantages of the online questionnaire were its speed, the instant availability of all its versions and its easiness to edit, and its preview, test and comment features, while the main disadvantages were technical difficulties (bugs) and the time needed to learn the tool. On the other hand, the disadvantages of the offline development were time needed and the difficulty of merging comments, slow communication and confusion with versioning. Rare comments related to advantages of the offline mode mentioned the ease of distinguishing between versions and clearer previews, which basically indicated room for improvement of the online prototype tool.

4. Discussion and Conclusions

Contemporary social sciences are increasingly supported with ICT (Jankowski, 2007; 2009a; 2009b). However, with regard to social-science research, only parts of this process – spanning from conceptualization to analysis and dissemination – have been fully integrated with ICT. Even when a certain shift occurred, it usually remained isolated from some other parts of the process. If we address the survey research process more specifically, integrated ICT support is provided predominantly for the fielding stage (i.e., computerization of questionnaire and data collection covered, both with standard CASIC), while other stages (e.g., questionnaire development) are either not supported or typically supported by separated ICT-based tools and services, which are not integrated into one platform.

We first addressed this problem by illustrating current deficiencies with an example from the 7EU-VET project, where a complex multi-language questionnaire was developed for seven countries. There, a word processor and email communication were substantially used for the development of the questionnaire. This was in large part a separate process from the creation of a computerized version of the questionnaire. Such non-integrated – although ICT supported – administration resulted in cumbersome procedures and many unnecessary complexities.

Further, we claimed that this deficiency does not derive so much from technical limitations, because we presented an example of a pilot study using a relatively simple academic prototype web-survey software tool, which already resolved corresponding technical problems. Instead, we argue that conceptual limitations were preventing an earlier and more effective integrative support of ICT for the survey-research process.

In the empirical part we showed that word processors and email exchanges can be entirely eliminated from the questionnaire-development process. The experiment revealed that participants who were designing an online questionnaire preferred doing so in one single platform, rather than switching between multiple tools. The results also indicated that even a relatively primitive prototype (online) solution was better than, or at least equivalent to, the standard process of questionnaire development, where initial sub-stages are performed in a word processor (offline) and exchanged via email (or via web).

The differences in perceived performance of the online and offline mode showed some tendencies in favour of the integrative (online) mode; however, they were non-significant. This was somewhat expected owing to a relatively small sample size, which was a potential limitation of the study. However, when asked about future preferences, the users clearly selected the integrated (online) version, which was additionally reconfirmed with qualitative assertions.

Of course, students as researchers may present an obvious limitation of the study; however, this does not change the internal consistency of these results. One may also raise the issue of the web-survey software tools used in the *control group*. Specifically, by using some other (i.e., better) software, the differences may shrink and lead to some other conclusions. However, extensive comparisons of this prototype with mainstream research tools showed no lag in performance, at least for the purpose of academic survey questionnaire development.

In the future, of course, inevitable progress of ICT integration is foreseen. Computer-assisted questionnaire-development and data-collection tools will increasingly support and integrate more and more stages of survey research. Specifically, the continuously evolving technological affordances such as increased speed, expanded implementation of Web 2.0 features and advanced SaaS (software as a service) platforms will undoubtedly enable more effective ICT support. We may already observe that more and more popular tools now enable the option of inline editing and inclusion of an elaborate commenting system. Nevertheless, this does not change our initial thesis that the lack of integrated conceptual thinking (i.e., e-social science) contributes to slower ICT integration of the survey-research process and social science-research in general.

We should also repeat that we address here the mainstream CASIC tools, and we do not include in our discussion the few very elaborate and expensive ICT tools and/or tailored ICT systems which support survey processes in some large data-collection organizations.

If we limit ourselves only to the questionnaire development stage, the ultimate solution would perhaps be an online word editor with the full functionality of the existing offline word processors together with an integrated full-scale commenting management system, which would support online collaboration between researchers. However, it seems that we are still far from this overarching goal, as currently even online word processors themselves seriously underperform compared to corresponding offline software.

Nevertheless, viewed from a broader perspective, beyond the stage of questionnaire development, the future will pave the way also for increased integrated ICT support for the entire survey-research process, including management, communication and other stages of pre-fielding and post-fielding. Of course, artificial intelligence, data mining and decision support will be increasingly used to incorporate human knowledge into this process (e.g., Grobelnik & Mladenić, 2005; Mladenić, Lavrač, Bohanec & Moyle, 2004). It is in this particular sense that we suggest that throughout these future developments, the implementation of the e-social sciences concept might serve as a sound conceptual basis for fostering a dynamic and theoretically grounded process of ICT integration into survey methodology. Needless to say, this can also contribute to the speed, quality and cost-efficiency of the survey process.

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