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A Multi-Method Approach to UX Requirements: Adapting to Agile & Lean Development

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Abstract. Agile and lean development projects are becoming a common practice among software development teams in industry. This new context poses adaptation challenges for traditional UX requirements methods. This paper summarizes a case study on coordinating multiple methods for requirements specification and validation during agile and lean development. In particular, it identifies four specific challenges, presents a commented list of the UX methods used with their benefits, and finally presents a few lessons learned on ways to orchestrate multiple UX methods as part of a program of research that runs along the development lifecycle. The 20-month development project here presented as context for such methods delivered Informatica Rev, an innovative software tool for data analytics by business users.

1 Problem

The *context* of this case study is a 20-month development project at Informatica Corporation that delivered Rev [9] (Figure 1). Informatica is a global software company with about five thousands employees. It develops innovative enterprise software for big data integration and analytics.

Rev is an innovative software tool to enable analysts in businesses to perform self-service data preparation (e.g., data analysts Sales and Marketing departments). The development of this tool is an example of an agile and lean process in an enterprise that needs heavy requirements specification and validation efforts. Two key factors motivated this need as the project started: new users and a new market. Data analysts are a new class of users, or unfamiliar personas, to Informatica, the company that built Rev. Moreover, data preparation applications are a new emerging market with no clear tools of reference (e.g., [6]).

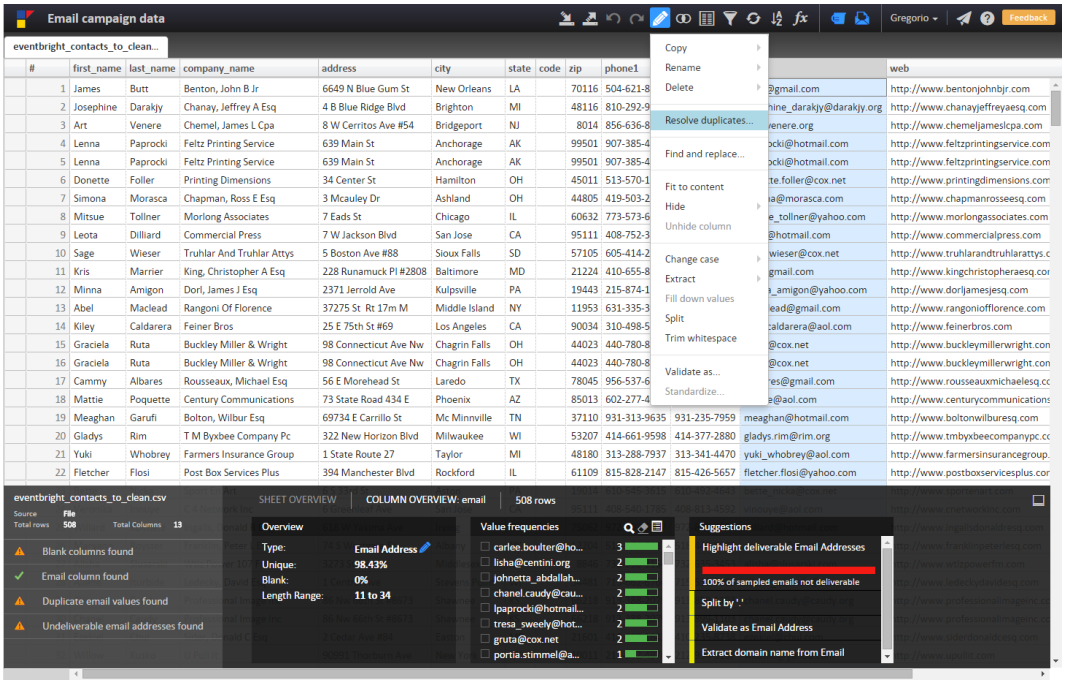

Figure 1. Rev Product. The reader is invited to try out the software for free via the URL in [9].

The *audience* of this case study are primarily professionals in user research, professionals in software design who need good requirements, and academicians teaching courses relevant to user research or software design roles. The practices presented are particularly relevant to large organizations that have integrated the roles of UX designer and UX researcher (or user researcher) as part of their agile development teams.

Consistent with the themes of the workshop, the *problem* tackled in this position paper stems from the practical challenges of applying traditional UX requirements methods to agile and lean product development. We outline below four challenges that user research professionals face today in this context. The first three are about effective UX method selection and orchestration; the fourth is about balancing different types of requirements.

1) *Some traditional UX methods are not compatible with the fast and iterative nature of agile and lean development processes* (e.g., field studies, ethnography, and large surveys). Thus adaptations of these methods need be developed to work with small-N studies and incremental research programs (e.g., [8]). In this case study, studies were run taking into account a development cycle with iterations or sprints lasting six to eight weeks, which suggests that the requirements studies should be planned, run, and delivered within one or two sprints periods. The use of a sprint periods of six to eight weeks, while

relatively long for agile development standards, it was required given the novelty and complexity of the Rev product.

2) *Traditional UX requirement methods are often used prescriptively as fixed-stage, fixed-purpose instruments,* rather than as mere "knowledge extraction instruments" that can inform design at *different stages and with different purposes*. The latter approach gives the UX researcher more flexibility to plan the investigations of requirements. For example, online surveys can be useful to supplement interviews early in the process, characterize new user classes later in the process, or validate designs after they are implemented. This is not intended to deny that methods can be more appropriate at given stages or for given purposes but it points to challenge for the UX researcher to distinguish the study method from the stage and purpose of the study. Making this distinction gives more flexibility for doing method selection or adaptation during the development cycle, which leads us to the next challenge.
3) There are various effective manuals that provide useful inventories of methods for UX requirements (e.g., [1]; [3]; [7]). However such methods are often proposed or mastered as atomic solutions. *The implicit assumption is that method selection and planning is done at the level of a 'single study' rather than as a 'program of user research',* which covers the full development lifecycle from early requirements and concepts to released product. Two observations from daily research practice falsify this assumption. First, requirements studies run within the same project are inevitably connected and thus decisions about methods of individual studies are impacted. For example, to address subsequent requirements questions, the UX researcher can run studies that apply the same method or *different but compatible* methods if these are more convenient (e.g., a survey with users can be an efficient way to extend the requirement specification work done in an earlier study that used interviews and observations with the same users). Second, the fast pace of lean development requires the UX researcher to plan incrementally and break the research efforts in smaller chunks, which makes the need to plan at the level of the research program even more evident: i.e., striving to *connect and coordinate concurrent methods* (e.g., two complementary methods) *and subsequent methods* (e.g., an incremental survey across iterations or sprints). The reader can also find a few additional insights on ways to connect qualitative and quantitative methods in [4].
4) When planning work on UX requirements and later when deriving implications for design, the UX researcher and UX designer, working

together, *need to accommodate non-user requirements that will inevitably steer the design and development* (see "Business Requirements" in [1]). Examples of non-user requirements in industry include: the company's product strategy (e.g., incorporating new features or capabilities in order to integrate with existing products by the same company), "appealing" features that the market requests via customers (i.e., when these are decision makers but not users), managers, or market analysts with influence on the product leadership (e.g., features that competitors are offering), and non-core features needed to increase adoption via partner companies (e.g., features to integrate with existing tools already used by analysts). The challenge for the UX researcher and the designer is to strike a good balance between user and non-user requirements, while protecting the consistency of the overall design.

To address the first three challenges above, the following sections present the case study in steps. The next section provides a chronology of the development project as context. Then, the following section presents a commented list of the methods used, which address the first two challenges. Finally, the paper presents four lessons learned on ways to orchestrate UX methods as part of a program of research that runs along the development lifecycle.

2 Context: Chronology of an Agile and Lean Project

Figure 2 provides an overview of the multiple user research methods used over 20 months, from December 2013 to June 2015, in support of the agile and lean software development process. The process led to Informatica Rev, a new software tool for business analysts (Figure 1). Besides the methods used to evaluate or refine designs (prototypes or live tool versions), multiple methods (e.g., workshops, user studies, and surveys) were also used to progressively scope, specify, and validate user requirements.

The requirements specification and validation process was launched at the end of November 2013. The team that worked on requirements included various professional roles: product manager, UX designer, user (or UX) researcher, senior user interface engineer, and a technical architect. In about three weeks, under the guidance of the product manager this small core team outlined the vision of the new software product and the hypothetical personas. In particular, the team consolidated the early requirement definitions during a multi-day workshop. The set of features envisioned for the new product was specified through a user story map [5]. In addition, an early description of two

hypothetical personas ("Line-of-business data analyst" and "Data hero") was outlined based on data collected by the product manager over the prior weeks (see top left in Figure 2).

The story map and the hypothetical personas became the starting point for the UX researcher and UX designer to run a field study with seven target users. This study specified and validated user requirements. In particular, it provides details about the target users, identifying the core persona (Appendix, Persona: Ops Data Analyst), specified their data preparation tasks (i.e., analysis projects and specific data manipulations) and key unfulfilled needs during data preparation. To adapt to the fast pace of the agile team, the small field study was planned, run, and its findings were reported within about six weeks, by mid-January 2014 (see challenges in the section above) (Study 1 in Figure 2).

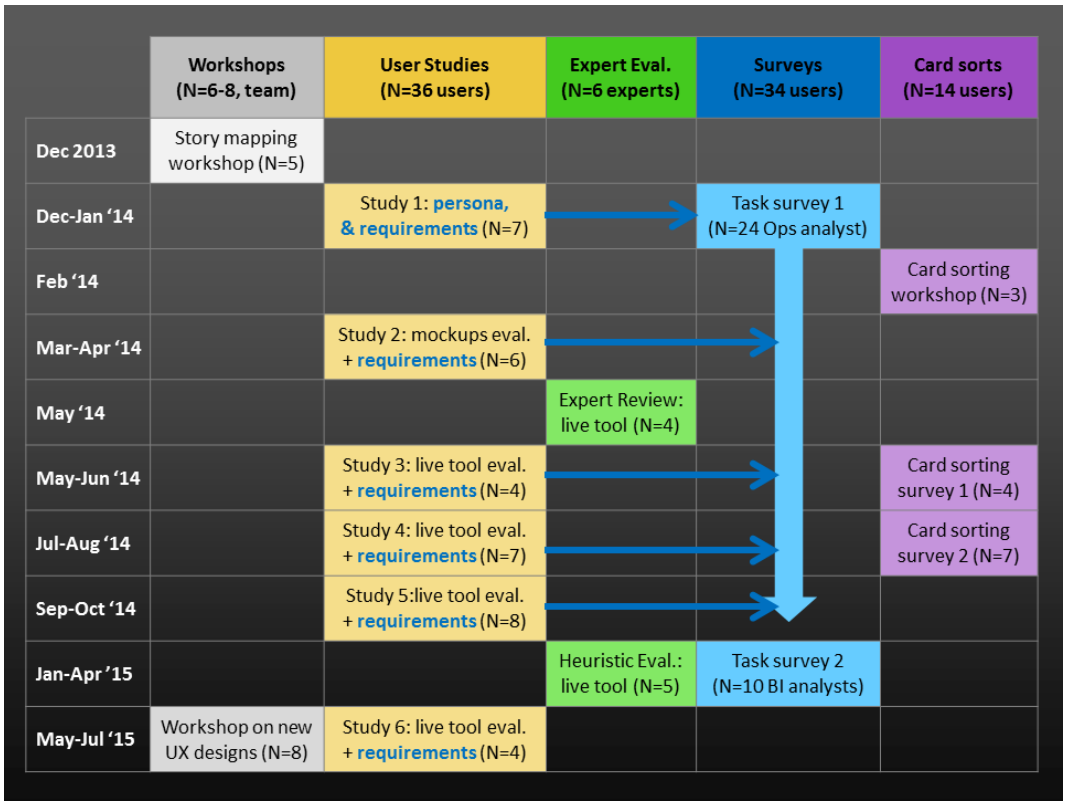

Figure 2. Timeline by UX method. The figure lists multiple user research methods used over 20 months, from December 2013 to June 2015, in support of an agile and lean software development process that led to Informatica Rev (see Figure 1).

Over the following two months, this requirement study helped the team focus its priorities. First, it gave the team a detailed description of the primary persona (e.g., with specific tools used, skills, and differentiated from the secondary persona of the data scientist). Second, it provided a short list of common data analysis questions, data manipulations, and data preparation

issues that the study participants faced (e.g., resolving duplicates, joining data tables), which helped to prioritize the feature to be prototyped. Third, these findings helped the team define two realistic and relevant scenarios for the envisioned tool. These scenarios became the context for a set of prototypes by the UX designer: storyboards with wireframes (e.g., how to enables duplicate resolution in Rev).

As the design converged on a first stable prototype, in the form of a storyboard, a first design validation study was planned and conducted with a small sample of six analysts, between March and April 2014 (Figure 2: Study 2).

Then, during the following year from May 2014 to April 2015 six subsequent design validations studies were run every time a new version of the live tool was released in the development process. These included four small-N studies with users (Figure 2: Studies 3-6) and two expert evaluations with UX experts (Figure 2: Expert Review and (adaptation of) Heuristic Evaluation). Concurrently, a small workshop with three end users and then two follow-up card sorting surveys were run to improve the subsequent versions of toolbar and menus.

While these studies focused on validating designs, from January to October 2014 the requirement specification related to the core persona (see Appendix, Persona: Ops Data Analyst) continued through a new method arrangement involving two complementary methods: a 20-minute interview about user tasks and needs preceded the design validation in each user study (Studies 1-5 in Figure 2), and an online survey (Task survey 1 in Figure 2).

In January 2015, a new key persona was discovered as relevant to the new tool. Thus, from January to April 2015, a second survey collected requirements about this new persona: Business Intelligence (BI) data analyst (Task survey 2 in Figure 2).

Finally, between May and July 2015, after a new user study on new features of the live tool, the team ran a second workshop to update the shared knowledge about personas and requirements (i.e., core personas with their key use cases and needs) and thus review what areas of the tool design required rethinking.

3 UX Methods Used: a Commented List

The reported uses of UX methods such as workshop, user studies, and surveys address primarily the first two challenges described in the Problem section. This section includes a list of methods that proved effective in the agile and

lean context and shows how some methods can serve different goals at different stages of the development cycle (e.g., user study, survey).

3.1 Workshop: Story Mapping and Persona Drafting

The first workshop involved four core members: product manager, UX designer, UX researcher, and a software development leader. The product manager outlined the product vision and then the team defining the user story map as initial characterization of the space of capabilities envisioned for the new tool (see Appendix, Persona: Ops Data Analyst). The team generated a user story map following the method proposed by Patton (2005). The workshop and subsequent conversations allowed the UX researcher to outline two hypothetical personas and user needs to be validated during user design. The personas were drafted using the method proposed by Gothelf and Seiden [2].

After about a year and half of design, user research, and development, the second workshop was run primarily for the team to update the shared knowledge on requirements (i.e., the core personas with their key use cases and needs) and identify what areas of the tool design require refinement or rethinking.

Workshops have useful advantages as UX requirement method:

- It is fast, typically can be completed a few days.
- The team can share understanding and build consensus quickly.
- The team can discuss personas in depth.
- The team can quickly unpack use cases and discuss their priorities.
- The team can understand competitive products and their UX.
- Facilitate rapid, iterative concept generation.

In brief, workshop can serve as a springboard to plan the design and research deliverables for the following iterations or sprints.

3.2 User Study for Persona and Requirements Specification

This first user study, run with seven data analysts, involved semi-structured in-person interviews and observations in the participant's office. The data analysts were recruited based on screening criteria agreed beforehand with the Product Manager and the UX Designer (Study 1 in Figure 2). The first outcome of this study was the validation of the two hypothetical personas: we used the persona format proposed by Gothelf and Seiden [2], as it lends itself well for lean UX. The second outcome was the specification and validation of requirements in the form of common analysis questions, tools used, data manipulation operations, and data preparation issues.

3.3 User Studies for Design Validation plus Requirements Specification

This second class of user studies involved semi-structured interviews, design walkthroughs, and recording of the user's screen during the interview session. These were always aimed at two goals. The primary goal was to evaluate the design. The secondary goal was to continue specifying requirements and characterizing users with their data preparation issues (Studies 2-6 in Figure 2).

3.4 Expert Reviews

In this case study, expert reviews proved to be a useful UX method to rapidly identify key issues in the design and collect principled recommendations on how to address these issues. As soon as the first live version of the tool was released, the UX researcher run a first expert review, which involved four experts. It took four weeks and provided quick feedback. Then, about a year later, a more systematic version of expert review was used, an adaptation of the heuristic evaluation method, which involved pre-specified heuristics and tasks (Appendix: Figure 7).

Expert reviews are a particularly useful in an agile and lean development when interleaved with user studies because the experts offer a type of feedback that complements the feedback from the target users. The feedback from the users who evaluate the tool ensures that the design is useful and effective: i.e., it addresses real requirements of real users in real task settings. The feedback from experts ensures that the design is simple and harmonious: i.e., it follows known design principles (e.g., easy navigation, clear visual design) and UX patterns expected for the category of the tool evaluated (i.e., tools for data analysis) (Figure 2: Expert Review and (adaptation of) Heuristic Evaluation).

3.5 Survey Studies

The two survey studies used the online survey method to address different requirements specification goals, at different stages of the development lifecycle. Each survey required about 20-25 minutes to be completed. It included Likert scales (i.e., frequency and importance of specific data preparation tasks) and a few open-ended questions (e.g., top three data analysis questions answered) (see sample questions in Appendix: Figure 8).

The first survey run in parallel with and supplemented the requirements specification process during the user studies, which contained brief interviews on tasks and needs (Studies 2-5 in Figure 2). This survey allowed the

researcher to systematically collect information on the profile of the users who had participated in user study (Studies 2-5 in Figure 2) and also quantitative ratings about the importance of specific tasks and needs (Task survey 1 in Figure 2).

Differently from the first survey, the second survey was conducted independently from the user studies. It addressed a specification needed later in the development process: a new persona was discovered as relevant to the new tool. This second survey used questions analogous to the first survey to allow comparing requirements (e.g., the most important data preparation tasks) between the new persona of BI analyst and the old core persona of Ops Data Analyst (Task survey 2 in Figure 2; Appendix, Persona: Ops Data Analyst).

3.6 Card sorts

This method was used to inform the design of the toolbar and the menus. A first workshop with a group of three end users who met in person was followed by two subsequent card sorting surveys each providing new insights on how to improve the toolbar and the menus (Card sorting workshop and Card sorting surveys in Figure 2).

4 Lessons on Orchestrating UX Methods

The lessons proposed below offer a few examples of helpful orchestrations of multiple UX methods during a lean and agile development project. It is worth noting that the lessons are the results of reflections by the author from this 20-months case study. They were shared and distilled during various discussions with different collaborators in the UX team at Informatica, one internal and two external to the Rev team. These lessons should be taken as work in progress.

While based on this case study only, the lessons represent a first set of solutions to the third (and hardest) challenge described in the Problem section. That is, they suggest ways for the researcher to connect UX requirements methods in a "pipeline" that is planned at the level of program of research (Figure 3).

4.1 Lesson 1: Transition from Team Workshop on Requirements to a Small-N Field Study on Requirements

A first lesson learned was that it was helpful to rapidly transition from early requirements drafting by the team during the initial workshop (the story map

and the draft of two hypothetical personas) to a small-N field study that validated key parts of these requirements. See section above for more details on the methods. See point 1 in Figure 3.

4.2 Lesson 2: Transition from Field Study to Remote User Study plus Surveys

Running field studies with in-person observations is often too costly or simply not feasible when the users are geographically distributed. The second lesson is that remote user studies (using interviews and screen recording) are an efficient way to continue the requirements specification effort started with the initial small-N field study. During an agile and lean development process, as the researcher sets up small-N user studies for validating subsequent design, it is useful and cost-effective to allocate about 15-20 minutes to a brief interview on tasks and issues, before the user starts the design validation session (Studies 2-6 in Figure 2). See point 2 in Figure 3.

4.3 Lesson 3: Combine Small-N User Studies with a Survey

A key limitation of user studies during agile and lean development projects is the small number of participants, or small N problem. A survey can address this limitation: i.e., systematically validate requirements with enough users to ensure external validity.

During the case study this result was achieved by combining subsequent small-N user studies with a concurrent online survey. The design of a survey became possible based on the initial field study (Study 1 in Figure 2) plus with prior research on the same class of users (i.e., data analysts), which had provided the researcher with enough variety of data preparation tasks and issues to construct an online survey. The data collected using the survey were then interpreted together with the qualitative data collected in the short interviews (Studies 2-5 in Figure 2, blue arrows, or point 3 in Figure 3), see lesson 2 above.

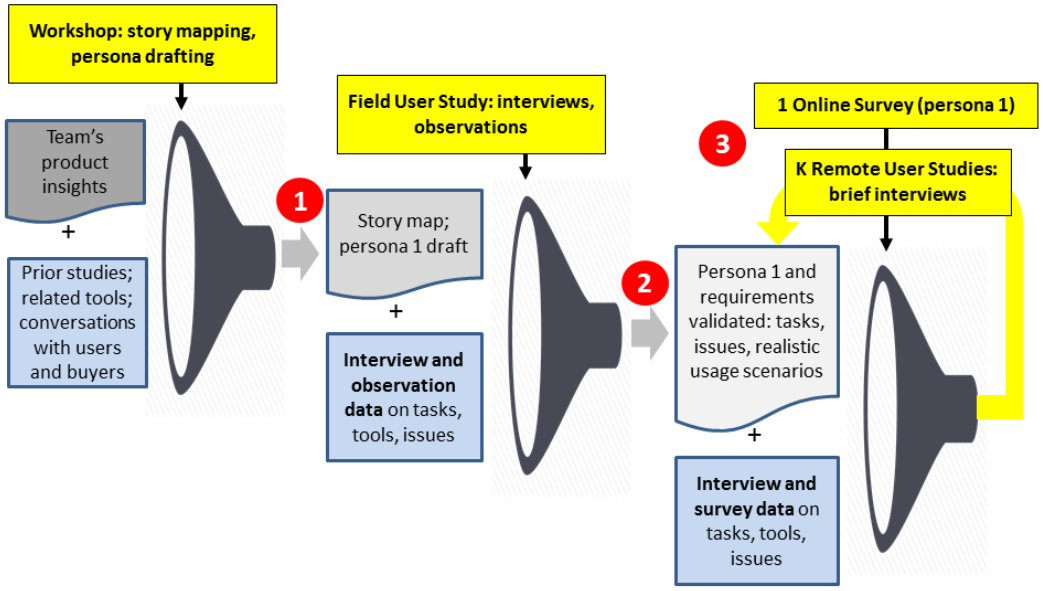

Figure 3. The pipeline model. The figure shows three UX methods to specify and validate requirements (workshop, field user study, and multiple (K) remote user studies combined with a single online survey) connected as part of a program of research. Each method uses multiple inputs to generate a more refined specification of the requirements (see grey boxes). *The three lessons described above correspond to the red labels 1, 2, and 3 respectively*. See also steps in Figure 2 from December 2013 to October 2014.

Figure 2 summarizes how three subsequent UX methods were connected to specify and validate requirements:

- Workshop (story mapping and persona 1 drafting)
- Field user study (interviews and observations)
- Multiple remote user studies (brief interview) combined with a single online survey.

The specification of requirements for the second persona, or persona 2, occurred after step 3 and is not represented in Figure 2.

4.4 Lesson 4: Use Follow-up Surveys to Profile New Personas

Later in the project, the use of a second survey proved useful for a different purpose: profiling a new persona (Task survey 2 in Figure 2). It allowed the team to systematically compare requirements (e.g., the most important data preparation tasks) between samples of users that represent two different personas, one known and one unknown. This was possible because the second

survey used questions that were analogous the first survey, with a few minor additions.

5 Summary and Conclusion

This paper presented a case study on coordinating multiple methods for UX requirements specification and validation during 20-month agile and lean development of an innovative software tool for data analysts. The paper makes three contributions.

First, it identifies *four challenges for traditional UX requirements methods* in agile and lean development

Second, it presents the *different UX methods used with the observed benefits*:

- Workshop: Story Mapping and Persona Drafting
- User Study for Persona and Requirements Specification
- User Studies for Design Validation plus Requirements Specification
- Expert Reviews
- Survey Studies
- Card sorts

Third, it proposes *four lessons on ways to orchestrate these multiple UX methods as part of a program of research* that runs along the development lifecycle:

- Lesson 1: Transition from Team Workshop on Requirements to a Small-N Field Study on Requirements
- Lesson 2: Transition from Field Study to Remote User Study plus Surveys
- Lesson 3: Combine Small-N User Studies with a Survey
- Lesson 4: Use Follow-up Surveys to Profile New Personas

Finally, two caveats for the reader. First, the lessons reported should be considered work in progress. They are the results of direct experience and post-hoc discussions with a few collaborators during the 20-month case study.

Second, there are fundamental limitations of Agile itself that were not discussed in this paper. Primarily, while Agile focuses on how to efficiently manage software development, the work on UX requirements, designs, and validation studies tends to be left off the table. But this goes beyond the scope of this paper.

6 Appendix

6.1 Story Map (sample)

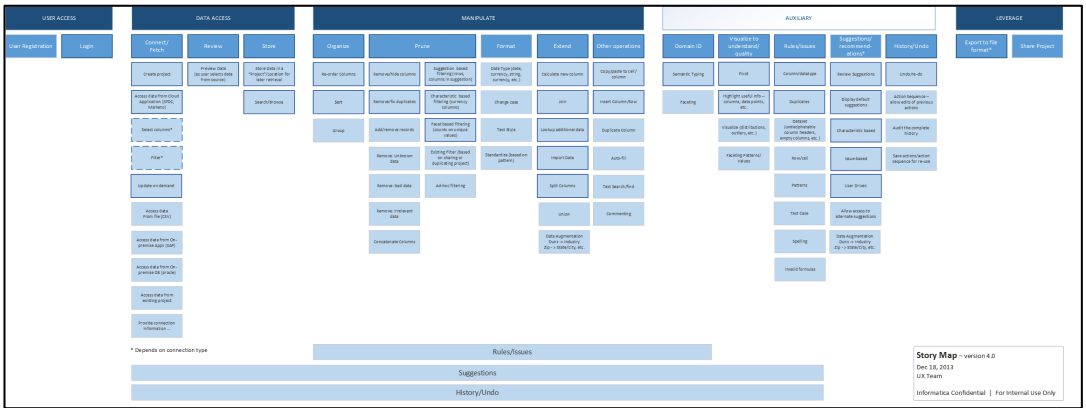

Figure 4. User story map. This is one of the user story map versions generated by the team during the initial workshop (December 2013).

6.2 Study 1. Persona 1: Ops Data Analyst – Mary

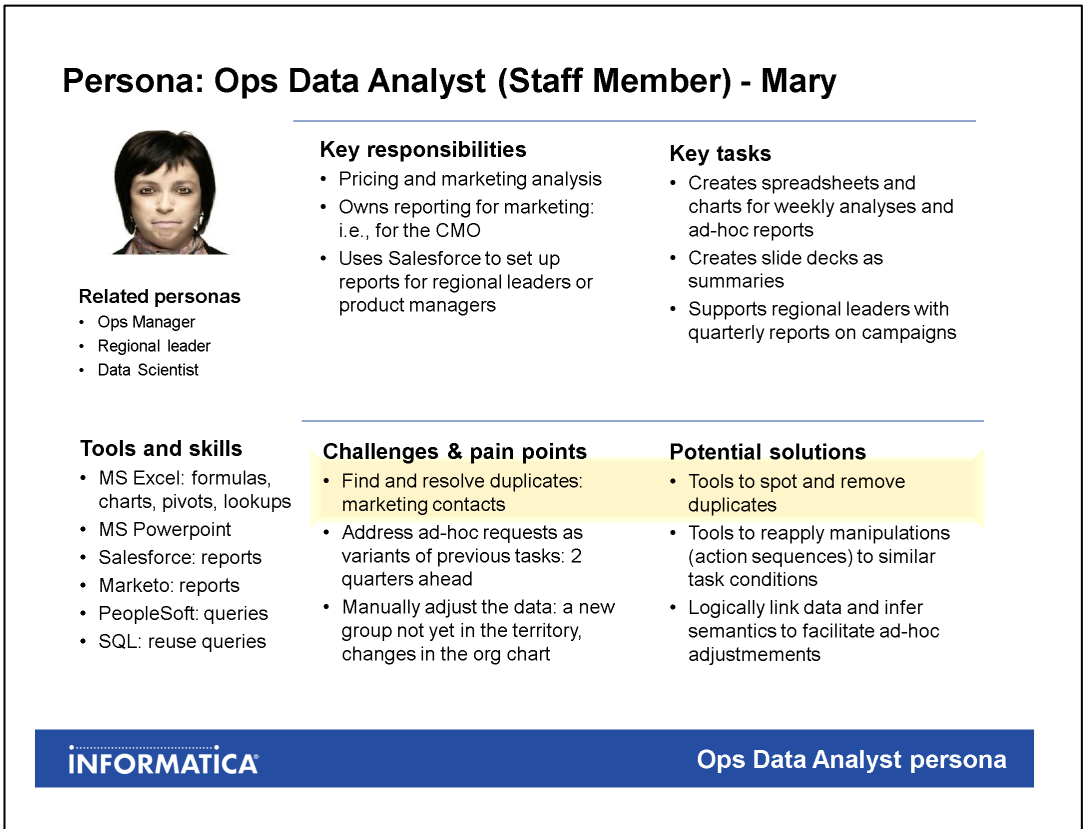

Figure 5. Persona: Operations (Ops) Data Analyst (e.g., Staff Member in Marketing Operations or Sales Operations). This is a version of the primary persona for the product delivered to the team as result of Study 1 (January 2014). It follows the persona description format proposed by Gothelf and Seiden [2].

6.3 Study 1. Requirements report (sample of findings)

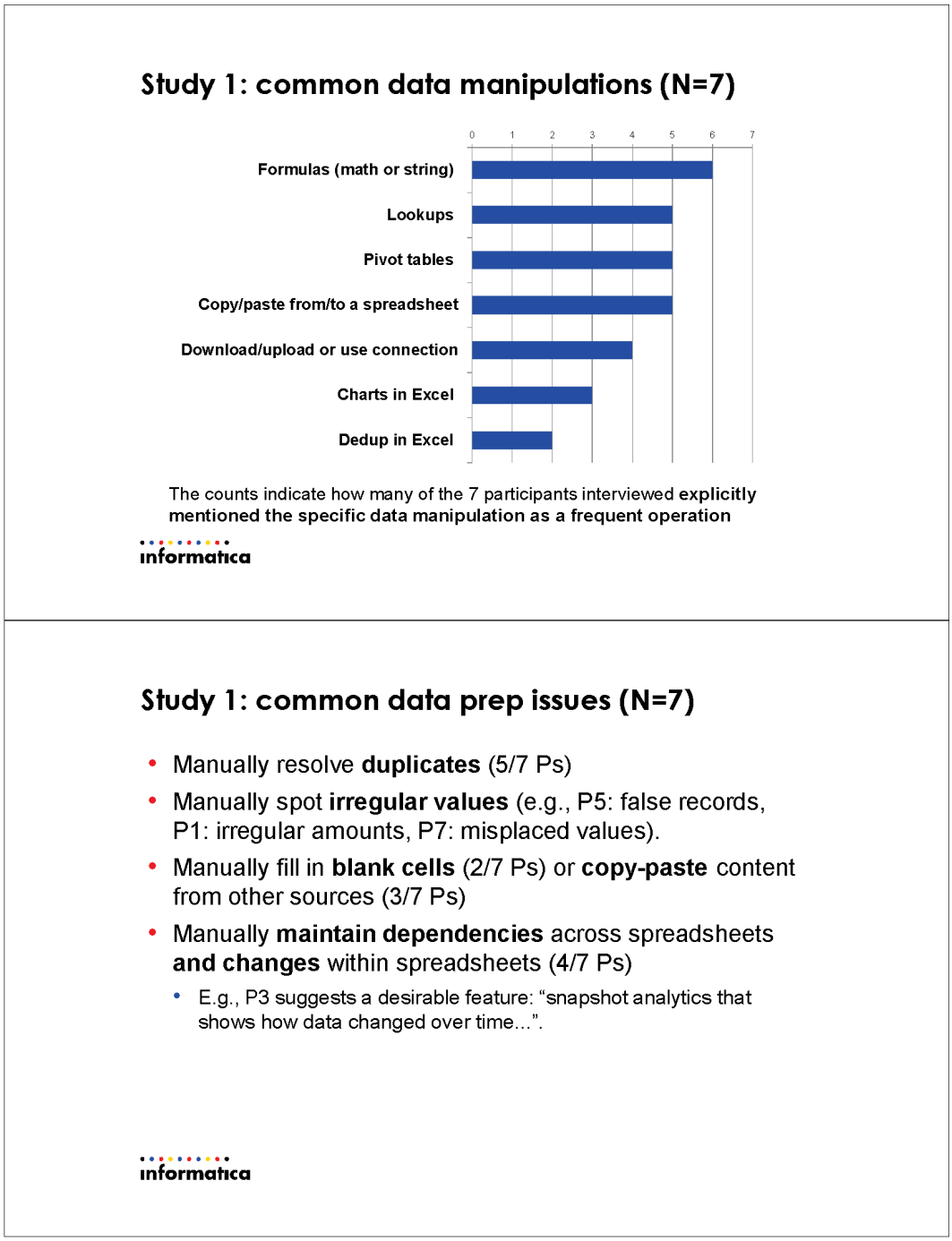

Figure 6. Study 1 requirements report: sample of findings presented to the team (January 2014). The top slide summarizes the common data preparation operations explicitly mentioned by the participants interviewed: i.e., operations to be supported. The bottom summarizes common data preparation needs that are poorly addressed by their current tools.

6.4 Heuristic Evaluation: an Adaptation. Heuristics and Tasks

		Heuristics
Generic	H1	Easy navigation & interaction (consistent and with feedback)
	H2	Clear visual design (controls, terminology, visualizations, layout)
	H3	Effective task flow or organization of operations
Prep-specific	H4	The UX patterns are consistent with common user expectations
	H5	The current prep task context is easy to understand
	H6	The next data prep steps possible are easy to predict
	H7	The tool supports data prep efficiency though automation and reuse
	H8	The tool includes key functionality expected in a data prep application

	Tasks
T1	Load, Understand, Improve quality
T2	Integrate data sets, Consolidate, Answer
T3	Add column, Aggregate, and Share via email
T4	Refresh aggregation based on new data and export the sheet

Figure 7. The second expert review used an adaptation of the Heuristic Evaluation method. It included the use of eight heuristics assessed by the experts in the context of each of four tasks. The heuristics and the tasks are listed above.

6.5 Survey Studies. Online Survey (sample of questions)

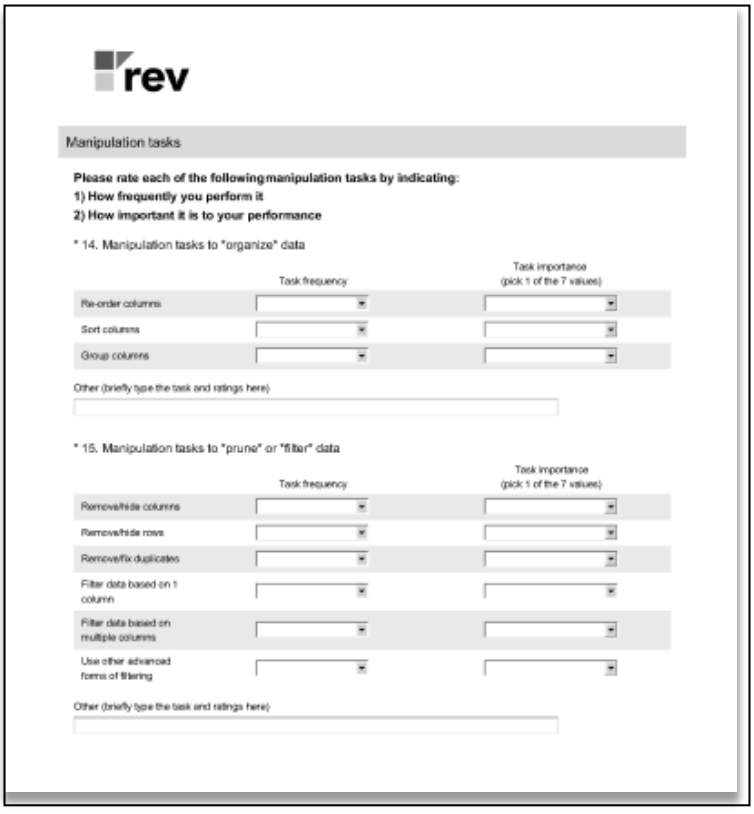

Figure 8. Online Survey. This method was used in two survey studies to collect requirements from each of two distinct personas for the Rev product.

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