The Evolution of VUI Design Methodology

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Introduction

How has VUI design methodology changed over the past decade? VUI design in the 1990s was very much a bootstrap operation, where applications were designed with good intentions, but largely by trial and error. VUI designers drew on knowledge of touchtone IVR design, general human-computer-interaction principles, and GUI design methods, but at that time there was no body of VUI design expertise to draw on. Very few large-scale public-facing speech applications had been designed before, so we were truly creating VUI design methodology as we went along. We had to adapt the methods from other disciplines to fit speech-enabled user interface design.

In reaction to our renegade beginnings, and in a rush for the title of "the experts," the early 2000s produced a torrent of rules, guidelines, and prescriptions for how to do VUI design, mostly based on professional opinion or small data sets. A few brave VUI pioneers published books on VUI design, based on the knowledge they'd gained so far, and most VUI designers happily clung to these guidelines because they conferred a measure of order and legitimacy to our profession. Having design guidelines and methodologies to reference helped us to establish VUI design as a legitimate project phase and job function, and helped us become accepted members of speech project teams. Early design methodologies also flourished because many VUI designers, by temperament, like the idea of a well-ordered universe.

Early Methodology

In the early 2000s, VUI design methods were defined rigidly: the same sequence of steps was to be applied to each project across the board, irrespective of the functionality being automated, the scope of the application, or the characteristics of the user base. For many of us, the sequence of steps outlined below is still assumed as the default, although this is written in the past tense. We know there can be problems with strict adherence to this sequence of steps, and that it does not address a number of concerns vital to successful VUI design, yet this series of steps is the de facto standard for VUI projects.

1. Requirements
    a. Collection and analysis of business goals, technology specifications, any available user data
    b. Document requirements and obtain sign-off
2. Design

    a. Produce preliminary design documents (sample dialogs, high-level call flows) and obtain sign off
    b. Produce detailed design documents (design specification with complete error handling, recognition parameters, and grammars; detailed callflows) and obtain sign-off
    c. Conduct usability testing (may occur after preliminary design, after detailed design, or following development)
    d. Simultaneously but separately, developers prepare technical specification and obtain sign-off
3. Development
    a. Code application per design and technical specification
4. Production
    a. Tuning

Projects began with a requirements phase, which often simply meant having the client document what functionality they wanted to automate; occasionally designers had access to some end-user data in the requirements phase, such as demographics of the user base or usage statistics. This gave the VUI designer a very limited understanding of the audience for whom we were designing, but requirements were typically the only data on which to base a preliminary design (typically including sample dialogues and callflow diagrams). After getting client signoff on the preliminary design, the next step was creating a full design specification in which the state-by-state behavior of the application is defined in terms of prompts, grammars, error-handling, and recognition parameters. Once the design specification is reviewed and approved, the application proceeded to development, a phase during which VUI designers were typically involved minimally if at all. Most VUI projects included at least one usability test somewhere in the process, sometimes following preliminary design, sometimes after complete design, or less commonly, following development. In some projects, VUI designers were brought back in during the tuning phase to help optimize prompts and grammars.

The Evolution of Processes

Over time, VUI designers became increasingly dissatisfied with this one-size-fits-all approach to speech projects. The rigidly defined methods were overkill for some small projects, but insufficient for producing good designs for many other projects. Consider traditional requirements analysis, with its focus almost solely on functionality and business logic. It works well enough when the client has a wealth of data about the behavior and preferences of end-users that we can use to inform our designs, but what about the majority of cases where the client knows virtually nothing about their telephone users? The traditional process leaves the designer to make choices without adequate data to back up design decisions. Similarly, running a usability test is good practice, but traditional VUI methodology doesn't define processes for gathering additional types of user data when it is needed to inform design decisions prior to prototypes used for testing. As the complexity and scope of speech applications became more ambitious, the rigidly-defined project methods became less useful, even detrimental. To

remedy this, VUI designers began to introduce additional methods for gathering user data, communicating with clients and the project team, and monitoring applications over time.

Today, rather than adhering to a set sequence of steps for each project, we have a collection of techniques that we can apply to fit the needs of each individual project. These techniques all fit under a philosophy of user-centered design and we can pick and choose the most useful and appropriate techniques from a toolbox of design methods according to circumstances of the project. We choose among the different tools based on the type of project, the sort of data required, where we are in the project lifecycle, and the time and budget available. Rather than having one tool for each stage of a project, VUI designers now have an array of techniques, each with its advantages and limitations.

A Designer's Toolbox

An ongoing goal of our profession is to continue to educate each other on how to best use the various techniques and to share new methods as we develop them. Understanding the methodology and the range of available tools is vital: by communicating the methods you intend to use and why they are important to the project, the designer can ensure that strong design methodology will be built into the project plan from the beginning. If a designer is unable to help the rest of the project team understand the value of the methods that should be used at the outset, the battle for time and budget will be uphill once the project is underway. When designers fully understand the techniques available to us, we can also align expectations of the client and project team with the value of the work to be done and the effort that everyone is going to have to put in to create a successful project.

Among the many tools now available for use by VUI designers are:

Customer Research/Usability Tools

- Conceptual research that explores new models of interaction and changes fundamental thinking about how IVRs should behave
- User interviews to understand user desires and state of mind
- Card sorting to determine mental model of menus and terminology
- Ethnographic research--observation in caller's environment, and then in the contact center to obtain two different perspectives on user experience
- Interviews with call center representatives
- User needs assessment to gain understanding users' unmet needs
- Task analysis to break down users' tasks into its component sequence of steps
- Diary/journal studies in which users detail their use of or need for technology
- Wizard of Oz testing--usability testing using mock-ups of applications
- AB Testing to allow direct comparison of two or more different design approaches to the same question
- Formal usability testing using prototype or fully-coded applications

Knowledge Transfer Tools:

- Functional and technical requirements document that establish application functionality from a technical perspective
- User stories to communicate needs and desires from the user's perspective
- Documenting expectations of speech recognition and application performance to ensure that clients understand what is possible
- Call center representative training to build consensus around the IVR and allow them to help end-users be successful
- Support documentation to facilitate a successful handover of a project to the client

Design Tools

- Sample dialogues showing a conversation between the IVR and a user
- Callflow diagrams to show possible paths through the application
- Detailed dialogue design document including initial and error prompts, grammars, and settings for recognition parameters
- Functional design specification to detail how the IVR interacts with other systems and the user
- Audio clips and montages to facilitate voice talent selection, and present vision clips or user stories
- Persona design to define the sound and feel of the application
- Peer reviews to validate the design
- Voice talent casting and coaching
- Concatenation algorithms to ensure optimal audio quality during playback
- Success metrics defined in the design phase as a way to set client expectations and agree on how to measure success

Monitoring and Tuning Tools

- Reporting plans including application logging and utterance recording
- Test plans, test cases, test data defined early in the project to facilitate complete and accurate understanding of application performance later
- Whole call recording to allow us to listen to complete interactions with end-users
- Reporting and data from Management Information Systems (MIS)
- Analysis of recognition results coupled with recorded utterances to provide a sanity check for recognition performance
- AB test results to determine which design provides a better solution to the problem
- Customer satisfaction surveys and interviews to get feedback directly from end-users of the system
- Agent interviews to provide an alternate view of the performance of the system
- Detailed usage statistics such as a diagram showing actual user paths through the application to reveal how users interact with the system

The Evolution of Attitude

Perhaps more important than the changes in technique are the changes in attitude that the VUI design community has undergone in the past decade. Two unfortunate traits that have historically been associated with VUI designers are defensiveness and superiority. The past decade has done much to change both how we see ourselves and how well we work within project teams.

In the past VUI designers had to defend themselves against coworkers and clients alike, who challenged our purpose on project teams and the activities we engaged in. Designers were engaged in a battle of whys: Why are you doing it that way? Why can't you use my prompt wording? Why will this work better for my callers? In a larger sense, we were constantly on the front line of the battle to defend "the benefits of speech" over other modalities, a mostly fruitless battle that produced a confrontational culture throughout the speech industry. Today, we know that speech is simply another channel that works alongside touchtone, web, and other interfaces. No one modality is inherently better than another; one is just typically more appropriate for a particular context of use. Because VUI design has proved valuable to clients, our employers and coworkers are typically more accepting of VUI design methodologies, which has allowed us to be less defensive. The competition for scarce time and money on project teams still exists, of course, so designers still have to defend some of their practices, but today we are on more equal footing with developers and others competing for resources.

Designers' tendency towards superiority is also changing. The highly specialized nature of VUI design can foster an attitude of "I'm the designer, so I know best," but this is an attitude that frequently alienates both coworkers and clients. We sometimes fell into this because-I-said-so behavior when we were unable to sufficiently and objectively justify design methods, principles, and decisions to others on the project team. Frustrating as it may be to the designer, not all clients yearn to know about or appreciate the intricacies of discourse markers or why ethnographic research is so valuable. What we've learned, however, is that it is hugely important to explain what we do, even in the face of boredom or hostility, in terms that the audience understands. We have learned that, in the end, it's better if clients and coworkers do what is in the best interests of design because they see how it affects the overall success of the project. Equally important is the way designers have learned to focus on the central role of data from end-users in making design decisions. We don't design it a particular way because that's what the designer says, but because that's what the *data* says. Yes, we are the keepers of valuable and specialized knowledge, but rather than taking the role of 'the expert' who's above the rest of the team, designers now work cooperatively and seek to show how user centered design principles can guide many decisions throughout a speech project.

The shift in designers' attitudes has changed the responsibility borne by our clients. In the past some clients just wanted to throw requirements over the wall and let us work our magic without truly participating in the design process. Such clients believe that VUI design is a subjective, creative activity with no more impact on a speech technology project than paint color affects a car's performance. This attitude allows and encourages clients to impose their own personal preferences for prompt wording and callflow when it conflicts with that of the designer. If design is purely the designer's subjective

opinion, clients can overrule it, even if it's an *expert* opinion. This sets up the oppositional situation in which the client insists that they know better than any designer and reduces the job of the designer to that of "specretary," documenting the client's demands. Now there are much higher expectations on both sides for the amount and type of client involvement throughout design.

Designers now have to work to educate clients to the fact that while design is creative, it is also backed up by objective, quantifiable data. We have reasons for choosing particular words and, yes, every single prompt does matter and can affect the overall user experience. We need to document not only the VUI design, but also the logic behind our design choices. By exposing clients to the rigorous methods behind good design, VUI designers strengthen their position as experts and validate the significance of their contributions to speech project teams. To make this happen, we must find ways to the ways that design choices impact the client's relationships with their customers. Clients may think their opinions on prompt wording are the most important factor until the designer shows them how the wording can influence the behavior and attitudes of the end customer—and every client cares about its customers.

Conclusion

VUI design methodology and the way VUI designers work on project teams has changed significantly in the past decade. The high-level phases on the project plan often look the same, but the activities within each phase are now more flexible and more robust than before. VUI designers rely more heavily on user and performance data than in the past and have developed many new techniques for collecting data throughout a project. As designers we are now able to work more cooperatively and in collaboration with others on speech project teams due to increased recognition of the importance of VUI design. We also strive to bring our clients in as partners in design which makes them appreciate the value VUI brings to the project and simultaneously helps them feel more personally invested in the success of the project. In the next ten years we expect to see continued growth of user-centered VUI design in terms of the range and types of methods available to us, our abilities to share and educate each other as a community, and our increasing influence in all phases of speech projects.