# Engaging health care providers in design research

Subtitle: Proposing future interaction designs for communicating with *limited English proficient* patients at the Emergency Department bedside.

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Abstract: The purpose of this research is to demonstrate how a *constructive and participatory design* process can facilitate dialogue between *University of Cincinnati Emergency Medicine* health care providers and designers regarding a future interaction design and overcome their conservative fallacy about the existing solution. *Conservative fallacy* relates to the notion that what exists today cannot be improved. Utilizing ethnographic and participatory design research techniques helped affirm the need to re-think how healthcare providers communicate with *limited English proficiency* patients at the exam room bedside. A set of design concepts was identified through the synthesis of personal ideation and the facilitation of a design workshop with 57 industrial design students at the *University of Cincinnati*. A total of 15 emergency department physicians, were involved in an experiment to validate design requirements and measure their perception about the design problem and current tools before and after interacting with the proposed concepts. Drawing from this experiment, design requirements were affirmed and the concepts were evaluated for further development. Furthermore, the study demonstrates how providers' attitudes about the design problem and urgency to address the issue shifted after exposure to proposed design concepts.

Key words: Constructive design, participatory design, healthcare, limited English proficiency, interaction design, conservative fallacy

# 1. Introduction

Designers are trained and skilled at conceptualizing new objects and manifesting them into reality. Making is paramount to their craft, and is what drives creative problem solving. However, when a designer is tasked to do design research, the usually will conduct their research *before* they make something. Research and design are commonly seen as separate activities whose processes do not overlap. Most literature on design research focuses methods for conducting research prior to creating a design concept. These methods concentrate on the early stages of the design process to help understand the design problem, context, user behavior, and other factors that may affect the design. However, few methods emphasize design as an activity in the research process. Because research and design are generally executed separately, often, there is a disconnect between research discoveries and final design outcomes. In a 2011 interview, Donald Norman discusses this gap between design research and design practice, "the relationship between the knowledge gained and the design of the product is often forgotten [1]".

This project couples both *constructive* and *participatory* design research approaches to understand the design problem, increase health care provider engagement, and identify key opportunities for product development. Participatory design provides the philosophical framework to involve users in the design process, while constructive design offers the artifacts to facilitate conversation between health care providers and designers. Constructive design research endeavors to bridge design research and design practice by integrating design practice into the design research process. Koskinen et al. [2], authors of the book, *Design Research Through Practice*, define constructive research as, "design research in which construction— be it a product, system, space, or media— takes center place and becomes the key means in constructing knowledge. Typically, this 'thing' in the middle is a prototype... However, it can also be a scenario, a mock-up, or just a detailed concept that could be constructed" [2]. The objectives of this research were:

- 1) To identify design opportunities and requirements to improve bedside communication with limited English proficient patients and providers in the Emergency Department.
- 2) To test if exposure to future designs can shift health care provider's perceptions about a design problem and their current tools.
- 3) To explore methods for involving health care providers in design research.

# 2. Background

#### 2.1 Design Case

This study examines the design case of improving communication between limited English proficient (LEP) patients and health care providers at the Emergency Department (ED) bedside. According to the Migration Policy Institute, the LEP population in the United States has increased from 13.9 million in 1990 to 25.2 million in 2010 [3]. The LEP population is likely to be undocumented. Thus, they have limited or no access to public and private health insurance. As a result, public emergency departments are one of their only gateways to access health care services, because they cannot deny care due to socioeconomic or immigration status. University of Cincinnati Emergency Department (UCED) was used as a case study to examine this issue. UCED is a level one trauma center, serving 90,000 patients annually. Twenty two percent of this population requests language assistance. The hospital staffs 11 interpreters, speaking a total of 13 languages. The top languages requested are: Spanish; Sign Language; and French.

# 3. Research Methodology

#### **3.1 Direct Observation**

Direct observation and semi-structured interviews took place during the ethnographic phase of research. 12 hour-log sessions of direct observation occurred during the course of one month. Observations consisted of 30 triage procedures along with three observations in exam rooms with LEP patients. There were four main objectives for conducting observational research. First, to experience the ED environment and understand the patient and health care provider culture. Second, to observe and analyze how current methods satisfy the communication needs of health care providers and LEP patients. Third, to understand the institutions protocols for

utilizing live interpreters and telephone interpreters. Last, to understand basic procedures for common ailments seen in the ED. In order to respect patient confidentiality only notes were taken during these sessions. Figure 1.1 shows the hospitals current methods for offering language assistance. These methods were divided into two categories: interpretation methods and communication tools / aids. Table 1.1 provides an overview of the advantages and limitations o the telephone interpretation line, the most commonly used method. Telephone interpretation began to enter U.S. health care environments in the early 1980s in response to the increasing immigrant population [4]. While many paradigms for delivering care and communicating in health care environments have changed since the 1980s, this model continues to remain relatively untouched in most U.S. health care settings.

Image: A construction of the constr

Interpretation Methods

Figure 1.1 Current methods for providing language assistance

Table 1.1 Advantages and limitations of the telephone interpretation lin	ine
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Advantages	Limitations
24/7 accessibility	Lack of patient / provider eye contact
Increased patient privacy	Lack of provider control of the conversation
Lower cost	Increased length or procedure
Professionally trained medical interpreter	Lack of infrastructure

# **3.2 Interviews**

Semi-structured interviews with nurses were conducted in 15-minute intervals during shift change at UCED using a discussion guide. A principal objective for interviewing nurses was to understand their attitudes and perceptions about their current language assistance tools, specifically the telephone interpretation line. Nurses were asked to discuss the challenges they encounter when treating LEP patients. When asked if their current tools could be improved, the majority of interviewees did not respond affirmatively. These interviews generated the notion of *conservative fallacy* and supported the identification of opportunities for improvement.

Additionally, the Director of Auxiliary Volunteers for interpretation services was interviewed. This discussion presented some of the logistical challenges involved in providing language assistance. The interviewee spoke about the challenges involved with on-demand availability of a live interpreter. She remarked that the most commonly used method for interpretation in the ED is the telephone. All interviews were recorded for further analysis.

# 3.3 Participatory Design

Two participatory design sessions occurred during the course of this research through a constructive design approach using design artifacts and tools to drive conversation with providers. The main goals of these sessions were to identify key opportunity areas, qualitative design requirements, and design proposals.

An hour-long participatory design research session was facilitated after ethnographic research activities and initial concept ideation. The session involved three design facilitators and one physician from UCED. The goals of this session were to present research discoveries and initial design concepts, so that they could serve as tools to stimulate conversation between the physician and designers regarding the identified problem and design requirements. Both research discoveries and interaction concepts were presented to providers as scenario sketches– a common design method for projecting future scenarios. A scenario storyboard describing the LEP patient experience was presented to express key issues from ethnographic research (Figure 2.1). Key findings were color coded on the scenario storyboard to express both patient and provider issues. A third category was included, which presented issues related to using the telephone interpretation line.



Figure 2.1 Patient experience storyboard





Figure 3.1 Proposed interaction concepts

In addition, three proposed interaction concepts were introduced using scenario storyboards. The concepts were: a shared tablet concept; a provider Bluetooth and patient tablet concept; and a clear shared screen concept (Figure 3.1). The storyboards helped the physician participate in a discussion about the implications of the proposed concepts. These artifacts initiated the discussion to shift the project focus from triage to the patient bedside. The provider also expressed favor toward a hands-free concept.

The second participatory design research session took place at a Research Interest Group. The session was 30minutes and attended by 18 Emergency Department physicians, residents, and researchers at the university. The participants were divided into groups of three and given probe packages containing: a LEP persona; a communication scenario; and a theme for design. The themes for design were: 1) a high tech solution that replaces the telephone interpreter line; 2) a low-tech communication tool, supplementary to the interpreter; 3) a software system that helps facilitate informed consent. Each team utilized the design tools to drive discussion and concept ideation. At the end of the session, the participants were given a questionnaire to evaluate their perceptions about the issue and their acceptance of their current tools for interpretation / communication, along with their desire to improve them. This exercise helped shape the evaluation experiment.

# 4. Ideation, Synthesis, and Concept Prototypes

#### 4.1 Concept Ideation Workshop

Shared Tablet

A concept ideation workshop was facilitated at the University of Cincinnati with 57 pre-junior industrial design undergraduate students. The purposed of the workshop was to test and refine design requirements based on measuring the proposed concepts with the established requirements. A secondary goal was to generate ideas and further concept development around the design problem. A total of 13 concepts were evaluated using a PUGH concept evaluation matrix, populated with high-level design requirements. Features of select concepts were recorded and passed onto synthesis.

# 4.2 Synthesis

During personal ideation, participatory design sessions, and the concept ideation workshop substantial ideas and concept features were documented and compiled. In order to organized the data and make connections amongst the ideas the list was synthesized into an affinity diagram. Based on the affinity diagramming exercise two concepts were selected to prototype and serve as stimuli for the evaluation exercise. Both concepts strive to provide better communication with the LEP patient and provider at the ED beside.

## 4.3 Concept Prototypes

The *Compa* concept purposes to replace the telephone interpretation line (Figure 4.1), whereas the *Bedside Board* (Figure 5.1) aims at supplementing communication between patient and provider. The Compa concept offers real-time, simultaneous translation via speech recognition software. The system has three components: 1) patient clip; 2) provider clip; and 3) tablet-based software application (Figure 4.1, 5.1). The patient and provider clips fasten to the clothing of each user. The clips have three main functions (Figure 4.1). The first is a microphone and speaker for audio input and output. The second is a speak button in order to initiate translation. Finally, each clip is equipped with an interpreter button to access a live interpreter via audio or video. The system includes a tablet-based software application, which provides visualizations, textual feedback from real-time translation, stock videos for common procedures, and the ability to view a live video interpreter (Figure 5.1).



Figure 4.1 Compa system and Compa clip



Figure 5.1 Compa graphic user interface mock-up

The *Bedside Board* is a hand-held dry erase board, which is accessible to the patient at the bedside of the Emergency Department. The concept is a patient-centered tool that empowers the patient to initiate basic communication with their provider without assistance of an interpreter. The board is equipped with a marker and works simply as a dry erase board. The patient is introduced to the board with simple instructions in their language on the backside. The front side contains both graphic symbols and text to support communication between LEP patient and provider (Figure 6.1). The board contains basic information that is commonly communicated at the ED bedside, such as pain re-assessment, general patient needs, and provider treatment plans and time expectations (Figure 6.1). The Bedside Board has five main content areas: 1) name area; 2) pain assessment area; 3) patient current status area; 4) patient need area; 5) provider area (Figure 6.1).



Figure 6.1 Bedside Board concept and content areas

#### 5. Evaluation Experiment

#### 5.1 Evaluation Experiment Design

The evaluation session took place for 30 minutes and involved 15 Emergency Department physicians. The evaluation session had three main aims. The first aim was to validate and measure the importance of the identified design requirements with providers. The second aim was to gain qualitative feedback on the proposed concepts. Finally, the third aim was to analyze and report on health care providers' level of importance before and after interacting with future concept prototypes.

Participants were randomly divided into three groups, each with five individuals. Each group was provided with different stimuli in order to conduct a sound experiment (Table 2.1). The tools used to conduct the evaluation were a pre-questionnaire, post-questionnaire; concept prototypes; and a concept evaluation tool. The questionnaires were designed to evaluate the provider's perceptions before and after exposure to the intervention (design concepts). Each prototype was introduced to participants with an instructional video and physical model. In addition, each concept was supplemented with a concept evaluation tool (Figure 7.1). This tool asked providers to rate their level of importance of design requirements and how each concept fulfilled the requirements using a Likert based scale. This tool also included three open-ended questions to gather more qualitative data about the concepts. Finally, the control group was given a set of cards, to serve as a discussion aide to stimulate conversation while the other groups interacted with the prototypes.

Time	Gro	up A	Group B			Group C (Control)		
5 min	Pre-Ques	stionnaire			Ì	Pre-Questionnaire		
10 min	Evaluation Form	luation Compa Evalu orm Prototype For		Compa Prototype		Discussion		
10 min	Evaluation Form Bedside Board Prototype		Evaluation Form	Bedside Board Prototype	Aide			
5 min	Post-Que	stionnaire	Post-Qu	estionnaire	j	Post-Questionnaire		

Table 2.1 Evaluation experiment overview

This concept is intended to t communication aide, not an	be a interpreter.													
		Please rate evaluate h	your level o ow the desig	of importanc an satisfies t	e of the de he listed fe	sign features ature.	and							
1 99 9	5 B	IMPORTAN	IMPORTANCE					DESIGN CRITERIA	_	CONCEPT EVALUATION				
		not important	of little importance	moderately important	important	very important				makes criteria worse	does not consider criteria	partially satisfies criteria	completely satifies criteria	
Are we leaving out any important design features?		0	0	0	0	0	01	provides direct patient / provider	01	0	0	0	0	
		0	0	0	0	0	02	offers flexibility for different provider's treatment styles	02	0	0	0	0	
		0	0	0	0	0	03	enables explanation of treatment plans / procedures	03	0	0	0	0	
		0	0	0	0	0	04	enables spontaneous interactions between patient and provider	04	0	0	0	0	
hy or why not?	mann four contexts	0	0	0	0	0	05	facilitates a clear informed consent process	05	0	0	0	0	
		0	0	0	0	0	06	considers contextual conditions of the ED (blood, urine etc.)	06	0	0	0	0	
		0	0	0	0	0	07	offers portability, so that it can travel with the provider, patient or both	07	0	0	0	0	
		0	0	0	0	0	08	supports patient / provider eye contact	08	0	0	0	0	
hat do you love or hate about the	r concept?	0	0	0	0	0	09	empowers the patient to have more control and initiate conversation	09	0	0	0	0	
		0	0	0	0	0	10	overcomes illiteracy issues (highly visual, auditory or both)	10	0	0	0	0	
		0	0	0	0	0	11	approachable technology for LEP patient demographic	n	0	0	0	0	
		0	0	0	0	0	12	provides comfort to the patient	12	0	0	0	0	
LOVE	HATE	0	0	0	0	0	13	informs the patient about waiting times and time expectations at the bedside	13	0	0	0	0	
		0	0	0	0	0	14	considers immediate implementation	14	0	0	0	0	
		0	0	0	0	0	15	considers theft	15	0	0	0	0	

Figure 7.1 Concept evaluation tool

# 6. Results

Importance

1) strongly disagree

2) disagree

Table 3.1 validates that nearly all of the design requirements generated during the course of the project, providers considered to be important. The results of the pre and post questionnaire disproved the notion of conservative fallacy amongst physicians. Most participants agreed that their current communication methods could be improved greatly. This demonstrated a clear difference between nurses and physicians regarding their perceptions about improving their tools. In terms of satisfaction with current tools, providers expressed a neutral attitude about the telephone interpretation line and other communication tools. The evaluation experiment demonstrates that the participant's level of importance regarding the problem increased after exposure to future design concepts along with their urgency to explore alternative options.

Table 3.1 Design requirement importance according to providers

3) neutral

4) agree

5) strongly agree

Design Requirement	Compa Importance (Mean)	Bedside Board Importance (Mean)
provides direct patient provider	4.7	4.6
communication		
offers flexibility for different provider's	3.8	3.4
treatment styles		
enables explanation of treatment plans and	4.6	4.05
procedures		
enables spontaneous interactions between	4.5	4.125
patient and provider		
facilitates a clear informed consent process	4.3	3.3
considers the contextual conditions of the ED	4.3	4.1
(blood, urine, etc.)		

offers portability, so that it can travel with	4.2	4.2
the patient, provider, or both		
supports patient/provider eye contact	4.3	3.5
empowers the patient to have more control	4.4	4.2
and initiate a conversation		
overcomes illiteracy issues (highly visual,	4.4	4.3
auditory, or both)		
approachable technology for LEP patient	4.4	4.0
demographic		
provides comfort to the patient	4.1	3.9
informs the patient about waiting times and	4.0	3.6
time expectations at the bedside		
considers immediate implementation	4.2	4.1
considers theft	3.8	3.0

Overall, physicians expressed more excitement for the *Compa* concept. They confirmed that voice-to-text translation would be a viable option for translation at the bedside. However, accuracy in translation was considered a issue to resolve before implementation. They stated that the *Bedside Board* would be a helpful tool for bedside reassessment, however they did not see much value in this tool because they would not be it's primary users.

#### 7. Conclusions

This research substantiates the opportunity to improve bedside communication with LEP patients in the ED. 15 high-level qualitative design requirements were identified and evaluated by 15 emergency medicine providers. From this study, a novel tool was created which couples objective user requirements importance against a conceptual design (Figure 6.1). This tool will be refined and evaluated by design teams and clients for future application.

Prototypes served as checkpoints during the course of the project to ensure that research insights were not lost in translation, that the design problem was framed appropriately, and to gain feedback on the concepts. Considering the time restraints of health care providers a design team must be strategic about involving them in the design process. During the course of this project it is exemplified that prototypes (scenarios, personas, storyboards, and physical models) served as tools to engage decision makers in the design process and gain rapid feedback for design development. These artifacts also help providers look into the future with you and explore future solutions.

It is important to note that health care providers are task oriented, thus involving them in a design activity or process must include a goal or semi-structured process to keep them engaged. Therefore, it is important to state why you are involving them, and what your goals for the exchange are. This statement does not underestimate their willingness to participate or contribute creatively. However, it is important to clearly articulate your goals of the interaction so they can align themselves with your research interests and collaborate.

# 8. Citations

<sup>[1]</sup> Holland, J. (Interviewer) & Norman, D. (Interviewee). (2011). Design Research and Innovation: An Interview with Don Norman [Interview transcript]. Retrieved from Johnny Holland It's all about interaction Web site: http://johnnyholland.org/2011/01/design-research-and-innovation-an-interview-with-don-norman/

- [2] Koskinen, I., & Jung-Joo, L. (2009) Proceedings of the 3<sup>rd</sup> World Conference on Design Research '09. Seoul, Korea
- [3] Migration Policy Institute. (2011, December). LEP Data Brief. Retrieved from http://www.migrationinformation.org/integration/LEPdatabrief.pdf
- [4] Kelly, Nataly. Telephone Interpreting: A Comprehensive Guide to the Profession. Victoria, B.C.: Tafford, 2008 Print.