

RE-REPRESENTATION AS WORK DESIGN IN OUTSOURCING: A SEMIOTIC VIEW

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Appendix A

List of Interviewees and Observation Sources

Table A1. List of Interviewees: Lifewood, Visit in September 2012

No.	Name	Job Title
1	Ronald Cheung	Executive Vice-President of VancelInfo* CEO and Founder of Lifewood
2	Christina Hui	Vice-President
3	Roger S	Vice-President Of Operation
4	Billy Lee	Sales Account Manager
5	Eric Kang	Productivity Director
6	Wilson Chong	IT Director
7	Snow Gong	HR Director
8	Yuki Wang	Assistant BD Manager
9	Jason Luo	Admin & System Manager
10	Janie Jiang	Operation Manager
11	Kathy Fu	Assistant Operation Manager
12	Michael Zhang	Operation Supervisor
13	Victor Xu	Senior Network Operator
14	Whitman Yu	IE Supervisor
15	Jay Lin	BD Supervisor
16	Luna Huang	Assistant BD Supervisor
17	Dominic Cheung	Accounting Executive

*Before the second wave of data collection VancelInfo became part of Pactera.

Table A2. Observation Sources: Lifewood, Visit in September 2012		
No.	Service/Project	Observants*
1	Airline	1 Supervisor and 9 delivery personnel
2	Genealogy (various)	4 QA Managers, 1 Supervisor, 1 Data Manager, 8 delivery personnel
3	New project planning (work package analysis) meeting (German registry)	Observations of a meeting that involved all members of the design team. Interviewees no. 1,5,6,7, and 10 (listed in Table A1) were present, and several more in different delivery centers of Lifewood participated via online video link

*Some of these observants were also interviewed with help of the interpreter.

A3. List of Interviewees: Lifewood, Visit in September 2013		
No.	Name	Job Title
1	Ronald Cheung	Executive Vice-President of BPO Unit, Pactera
2	Roger S	Vice-President of Operation
3	Whitman Yu	Workflow Manager
4	Todd Zhou	Project Manager for German registry
5	Wilson Chung	IT Director
6	Amy	German registry Supervisor
7	Rebecca Cao	Airline Supervisor
8	Laura Liang	Pricing Manager
9	Cathrine Pan	Airline Project Manager

A4. List of Operators Observed and Interviewed*: Lifewood, Visit in September 2013		
1	May	German Registry delivery personnel
2	Elva Lu	Airline delivery personnel
3	Frank Xiao	Airline delivery personnel
4	Sun Bian	Airline delivery personnel
5	Katy Ling	Airline delivery personnel
6	Purple Hao	Airline delivery personnel
7	Rubie Ning	Airline delivery personnel

*All delivery personnel in Table A4 were interviewed with help of the interpreter.

Appendix B

Case Study: Design of Work for the Airline Service

In this appendix we aim to demonstrate how the work design team designed outsourced work for a typical airline service. We intend to complement the description that is provided in the body of the paper focusing on the genealogy project. Therefore, to avoid repetition, we only focus on aspects of the airline service that are specific for this real-time service. The airline work was considered as an ongoing service. New types of documents (e.g., for different airlines) could be added over time but the delivery of this service was based on real-time processing of incoming images.

Background of the Airline Service

Since July 2011, Lifewood has been providing transcription service for Cathay Pacific and other airlines (hereafter the airline service). This service involves transcribing handwritten aircraft maintenance documents such as forms and work orders (see Figure B1) that are filled out by engineers in the field, scanned, and sent as digital images¹ to Lifewood. A typical maintenance form contains, for example, information about the action taken to resolve an aircraft malfunction with specific information about the parts replaced, the part number, and the date and time of the repair. The Lifewood delivery personnel have to transcribe information included in these documents into a digital template, which is linked directly to the airline’s enterprise system (e.g., each field marked in purple in Figure B1 had to be recorded). As a real-time service to the airline, this has to be completed within a short period of time (e.g., 30–40 minutes from the time the scanned image is received by Lifewood).

Item No.	Continuation Work Sheet	Sect. Code	Man-hours	Mech.	Auth.
1	Remove No3 ENG SPLITTER PANELS 4 off Work Done: 2 EA SPLITTER PANEL REMOVED AS PER ANM 72-03-00	LAM2	3.0 3.0 LAM7-10	Sign: [Signature] Staff No: [Number] Date: 04 SEP 2010	Sign: [Signature] Auth No: [Number] Date: 04 SEP 2010
2	INSTALL No3 ENG SPLITTER PANELS Work Done: SPLITTER PNL S INSTALLED	(AM)	3.8 3.8 LAM7-10	Sign: [Signature] Staff No: [Number] Date: 04 SEP 2010	Sign: [Signature] Auth No: [Number] Date: 04 SEP 2010
3	REMOVE No3 ENG COMBUSTION CHAMBER PANELS Work Done: 2 EA COMBUSTION CHAMBER PANELS REMOVED AS PER ANM 72-03-00	LAM2	2.0 2.0 LAM7-10	Sign: [Signature] Staff No: [Number] Date: 04 SEP 2010	Sign: [Signature] Auth No: [Number] Date: 04 SEP 2010

Figure B1. An Example Image from the Airline Service

¹In contrast to the genealogy project where one image usually contained several records to be transcribed, in the real-time airline service (for Cathay Pacific) each image was associated with a single record—a work order or inspection report—which was often lengthy and complex (as shown in Figure B1).

Design of Outsourced Work for the Airline Service

Analyzing the Work Package

Similar to the genealogy project, the design team examined the client's requirements, which included background about the documents and distinguished between different types of documents (e.g., maintenance records and work orders) for different types of aircraft. They examined the fields to transcribe for each document type, how to deal with missing information, accuracy level, and the technical format of the enterprise system where the information should be entered. When analyzing the airline's images, the design team was mainly concerned with the quality of the handwriting and the general format (i.e., structure) of the documents.

Creating Supporting Materials

Like the genealogy project, supporting materials were intended to guide delivery personnel regarding how to find and recognize what was relevant, and what belonged to which field of the digital template, from all that was included in the given document. The structure of each document type was captured into keying instructions (KI) that included explicit rules and instructions for operators to follow. The KI for the airline service explained (mainly in Mandarin) about where in the image of the document to look for text to be entered into each specific field of the digital template (see Figure B2).

#	Field Name	Instruction (Mandarin)	Field ID
1*	A/C REG#	输入图像上的内容 格式为B-XXX 或XXX-	
2*	1. JOB NO#	输入图像上的内容	
3*	2. PAGE#	输入图像上的内容	
4*	2.1 ORIGINATING CARD#	输入图像上的内容	
5*	SERIAL NUMBER	输入图像上的内容 (注意: 下面这种风格的图像是不用输入这个位置的)	
6*	DATE_1	输入时日期格式为DD-MMM-YYYY 注意: 下面这种风格的图像是不用输入这个位置的)	
	以下栏位为Item 编号		
4*	3 ITEM#	输入图像上的内容	
5*	4 Work Requirement/Defect#	输入图像上的内容	
6*	4.1 TRADE#	输入图像上的内容	
7*	4.2 ESTIMATED MANHOUR#	输入图像上的内容	
8*	5 OPEN UP/REMOVAL#	输入图像上的内容, 符号后面需空格, 一般只有斜杆或撇号后面不用空格, 不过也要看图像而定	
9*	6 AUTH#	输入图像上的内容, 通常为印章, 取 后面第 6 位数字, 取后面不用空格	
10*	7 DATE#	输入时日期格式为 DD-MMM-YYYY, 如 09-MAR-2009	
11*	8 CLOSE UP/RECTIFICATION/ACTION#	输入图像上的内容, 符号后面需空格, 一般只有斜杆或撇号后面不用空格, 不过也要看图像而定	
12*	9 AUTH#	输入图像上的内容, 通常为印章, 取 后面第 6 位数字, 取后面不用空格	
13*	10 DATE#	输入时日期格式为 DD-MMM-YYYY, 如 09-MAR-2009	

Figure B2. Keying Instructions for the Airline Service

The design team also examined variations in handwriting styles and developed supporting documents capturing key visual images for operators to learn to recognize. They identified and captured repeated words (see Figure B3), which were included in the data dictionary training.

REV	REVIEWED	REVIEWED	STATIC	STATIC	BUSHING	REMOVED	REMOVED
ITEM	PROTECTION	PROTECTION	DAMAGE	DAMAGE	UPPER	CAPPED	CAPPED
VIDEO	REINSTALLED	REINSTALLED	RESECURED	RESECURED	ACTUATOR	ACTUATOR	RESEATED
VANES	COMPRESSION	COMPRESSION	REPLACED	REPLACED	UP ALL	UP ALL	VALVE
RESULT	LEAK	LEAK	TOUCHED	TOUCHED	AXLE	AXLE	REPLACED
	LIMIT	LIMIT			ATSLR	ATSLR	TABLE

Figure B3. Examples of Frequently Used Words in the Airline Service

Developing Digital Infrastructure

Physical documents completed by airline engineers were scanned at the airport locations and thus arrived at Lifewood as digital representations of the physical records uploaded to the LiFT platform. Figure B4 shows how operators saw the digital representation of a typical document on their computer screen via LiFT interface. Similar to the German registry example included in Figure 8, Figure B4 shows the digital template and data dictionary linked to the field “RECTIFICATION.” As Figure B4 shows, there is a long text string to be transcribed into this field of the digital template; the dictionary now shows possible entries for the third word (“deck”) in the text.

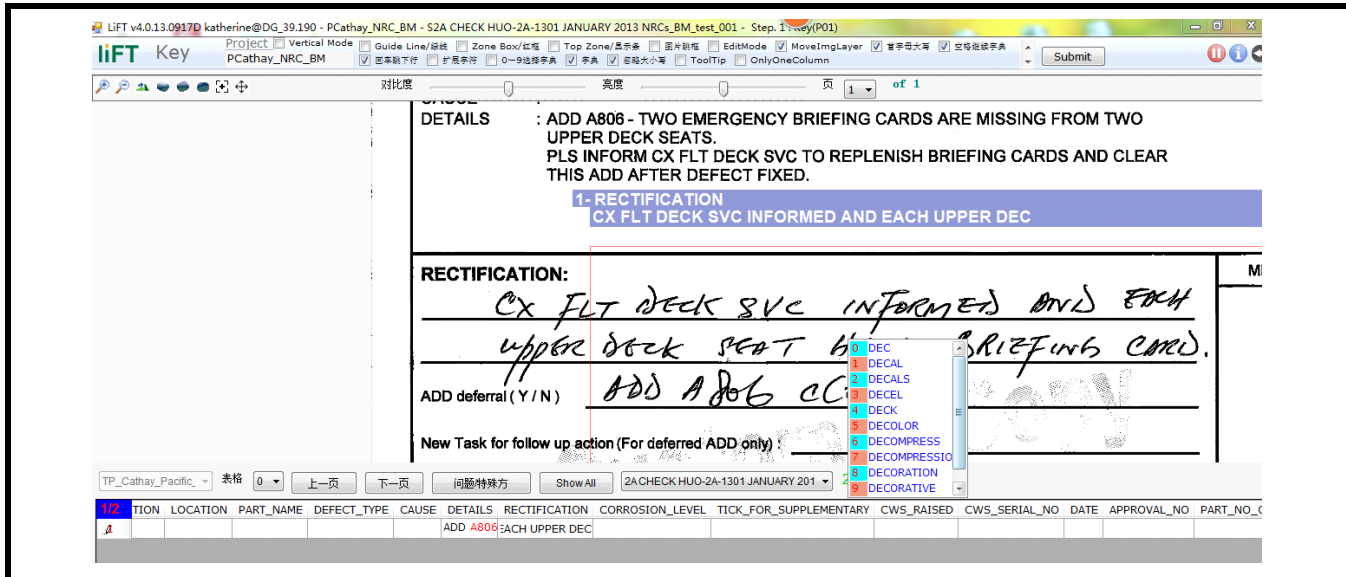


Figure B4. Digital Template and Dictionary in the Airline Service (Example)

The digital infrastructure also included a visual enhancement of certain features on the computer screen in order to improve the ergonomic experience for the operators (i.e., to maximize their productivity). For example, words offered by the data dictionary appeared with numbers and a color scheme (see Figure B4). The following quote and vignette² conveys the design philosophy behind the visual aspects of the data dictionary design:

[For the airline service] *because the response time is very critical, so we must use the customer's system for that [to enter data directly into the customer's database]. But using that system was very slow, so we uploaded it to our system. The way they had designed the system was not very productive for our operators, so it was not very good. So our operators said, "OK, if it was designed this way, it's much better for us to key in without moving the head and the eyes and holding things up," so our team designed a system, a template, which is different from the customer's template.* (IT Director)

Vignette 1

A member of the design team explained that, in the dictionary, more popular words appeared higher on the list. In total, about six to eight words appeared on the list. The left column offered the index number of each dictionary word with a turquoise and red color scheme alternating between odd and even numbers. A selection of a word was made by typing the index number (for example, “5. Repair” required the delivery staff to type “5”). When we asked about the purpose of the color scheme (in addition to the numbering scheme), the design team member explained that the color scheme was so designed because it helped delivery personnel to quickly realize the number without having to carefully count or examine the number scheme. For example, the team member would know that typing “4” would enter the word “deck” by looking at the turquoise and red colors—three turquoise (0, 2, 4) and two red (1 and 3) means “4.”

²This vignette is based on several data sources including our observations and interview data.

The functionality of the data dictionary was designed to assist the delivery personnel to recognize handwritten images faster and with greater accuracy. In particular, as illustrated in the vignette, words (e.g., airline parts) used more frequently in a specific field appeared higher in the dictionary window, matching first character(s) typed in the field, with real-time algorithms collecting frequency information and updating frequencies as team members transcribed documents. The dictionary algorithms also flagged any new entries to the QA team so that new entries could be reviewed by the QA team before being added to the dictionary.

In the same way as in the German registry project, words typed in a specific field of a digital template were red or black. If a typed entry did not appear in the dictionary associated with the specific field, then the color of the letters was red (see “A806” in red in one of the fields of Figure B4), while entries already in the dictionary were in black. The red color was intended to signal to delivery personnel that there might be a mistake in the way (s)he typed the text.

Additional ergonomic features included the re-centering of the digital document on the screen. The red rectangle in Figure B4 in the middle of the screen shows the text that is currently being transcribed (i.e., the word “deck” is centrally positioned on the screen).

A digital workflow designed for the airline service sequenced activities and monitored the application of explicit and implicit rules, from the moment the image of a handwritten record was uploaded until it was transcribed into a digital template and submitted into the airline’s enterprise system, creating backup and reporting. Operators were often unaware of the rules that the digital workflow was based on. For example, in the airline service, the design team applied a design rule in which documents of a certain template were transcribed by a specific (sub-)group of operators. The digital workflow also applied rules concerning which images were sent to the QA team for quality assessment. The workflow was modified over time as the design team identified areas that could improve the service. Figure B5 summarizes the changes in the workflow for the airline service.

Item	Date	Author	Remark
1	2011.7.14	Whitman	Version 1.0 for NRC project workflow
2	2011.8.23	Whitman	Version 1.1 1) remove 7.0 2) change “9.0 import job number & key(Lifekey)” and “10.0 MK_1ST” to “8.0MK1st(key+MK1st)” 3)remove “19.0 check output data(check free text field(defect,rectification,open up/removal))”
3	2013.5.20	Whitman	Version 1.2 1.change the system from lifekey to lift 2.change “8.0 MK1st(key+MK1st)” to “7.0key(lift)” 3.combine the original process 9.0-12.0 to 8.0-10.0

Figure D5. Changes Made to the Workflow of the Airline Service