

Understanding Service Quality and Customer Churn by Process Discovery for a Multi-National Banking Contact Center.

Peters, Edward M.L.
OpenConnect Systems Inc.
Dallas, TX United States
epeters@oc.com

Poelmans, Jonas
Data Discovery Science BVBA
Belgium
jonas.poelmans@gmail.com

Dedene, Guido
Faculty of Business and Economics
KU Leuven
Leuven, Belgium
University of Amsterdam
guido.dedene@kuleuven.be

Abstract— Churning of the customer base is always a top issue in Banking. It is directly related to recurrent revenue, and the ever increasing acquisition costs for new customers. In a first approach, this issue is related to both the quality of service (which is mainly in the front-office, say the contact center) and the speed of service, which is mainly in the back-office. Many studies published to date on this required manual data collection. This creates in general two concerns: worker behavior may change under observation, and manual data collection is expensive and often error prone. In this paper it is shown by means of a case study for a Multi-National Bank (with 5000 employees in the back office) how automated Business Process Discovery, which is an advanced type of process mining, makes it possible to handle the above concerns. The automated data collection and the analysis, in terms of Hidden Markov Models, are key elements. Several results regarding the quality and speed of service have been obtained. Most interesting was the discovery of deeper root causes for customer attrition. Once the deficiencies in the processes are identified, appropriate process improvements can be designed and simulated based on the models emerging from process discovery. In this case study, significant quality and speed improvements as well as customer churn reductions have been obtained.

Keywords—customer churn; process discovery; quality of service; process improvement

I. INTRODUCTION

In this paper specific techniques (based on data and process mining) are proposed to gain a deeper understanding of Business processes that involve ICT-based care-type of services (Peters 2013). In contrast to administrative or transaction-type, “batch”-like services (such as claims processing), “care-type” of services heavily rely on a two-way interaction (McAfee 2006) with the users of the services, the customers. Transaction services are increasingly performed

with the aid of software robots, whilst the automation of “care-type” of services is still beyond the capabilities of current software. In “care-type” of services the value and quality of human-to-human contact are often an area of focus. Hence, this interaction, while a focus for efficiency, is moderated within an element of quality. Specifically, what good is it when a process is simultaneously both fully automated and fully hated by the users of the process? This level of dissatisfaction can show up as low customer satisfaction rates and possibly declining enrollments and revenues (Mercado et al., 2012).

In this case study, these issues are investigated for a world leading European financial services institution, a Multi-National Bank (Peters 2013, Houck 2007). The driving engagement was with the retail banking division, which was seeking targeted initiatives to reduce costs and improve customer satisfaction within call center, back office and self-service operations. The bank has over 600 individual processes and over 5,000 employees involved in these areas.

One final introductory remark: this paper is not about the optimization of banking call center processes. This topic is important and has been covered in (Koole 2013). An additional case study focusing on value leaks in the call center processes is included in (Peters 2013). This case study is about the usage of heterogeneous data (including call center system data) to discover and understand issues in Service Quality, and Customer Churn in particular.

II. GOALS

The goal of the effort was to identify ways to reduce costs, and increase revenue across the retail banking operations. The retail services span across both front office (contact center) and back office processing. Cost reduction could come from one of two areas: improve the speed (productivity) of service; or

improve the quality of service (Triplett & Bostworth 2000). Revenue increases are driven directly through improvements in customer retention that requires a better understanding of customer churn.

A. Speed

Small improvements to the time taken to execute services, either in back-office processing or in the customer contact center, may produce large savings in staffing costs. As such, this organization had a large staff of trained business process improvement professionals that had executed many studies of the operations looking for improvements. It turned out that a major problem in these studies was the data gathering, which was primarily manual. This is expensive and may lead to errors influencing the results of the studies.

B. Quality

Defining Quality in a retail service organization is difficult. The organization in this case study had not yet reached a way to measure quality on a consistent basis. In the literature, several relevant measures are proposed, such as the “first contact handling rate” (Zbikowski 2007) for a contact center, which measures the percentage of problems that are adequately handled in one contact (regardless of the customer contact time, which is sometimes considered as the primary measure).

C. Customer Churn

Customer attrition is a major concern in banking. There is the large cost of customer acquisition and the main revenue driver is the sustained long-term recurrent profit driven from each account. Examining customer churn, and trying to identify specific causes or leading indicators is hardly possible to do on an ad-hoc manual analysis basis.

III. A TECHNICAL ARCHITECTURE FOR AUTOMATED BUSINESS PROCESS DISCOVERY.

The approach taken in this case study was to provide a proof of concept for Business Process Discovery (Cook & Wolf 1996), (Peters et al. 2007) based on the Comprehend toolset of U.S. Dallas-based OpenConnect Systems (Peters 2013). The study was embedded into the Business Process Improvement department of the bank, that held the responsibility for the complete Retail Services Organization.

During this study, Comprehend collected and analyzed user activity for one week, with the focus on six Business Processes. To enable this automated data collection, two span ports had to be configured:

- a span port on the TCP/IP connection to collect all TCP/IP traffic between the contact center & back office processors and the servers used for the applications supporting their respective business processes
- a span port to collect all HTTP traffic between the customer a the self-service web application and the web server.

Additionally, the log files created by the Interactive Voice Response (IVR) system were imported into Comprehend to enable analysis on customer behavior using the IVR system.

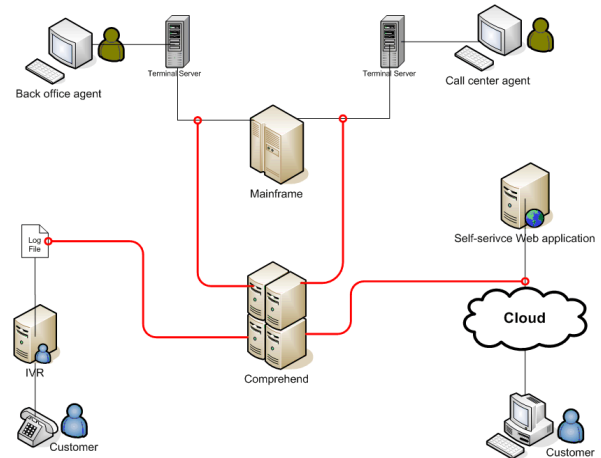


Fig. 1. How to gather the data from the Back office and Call center systems

Manual data collection has several drawbacks (Viaene & Van den Bunder, 2011): customers may change their behavior when they know they are observed, and the manual collection process is costly and error prone. The automated data collection technology is non-invasive, transparent to the users that are involved, and results in standard XML-data that are relatively easy to audit and verify (Peters 2013).

The major process discovery techniques rely on clustering detailed process steps that coherently belong together into services, and next an application of Hidden Markov Model learning techniques (in combination with Formal Concept Analysis), the detailed techniques are discussed in (Peters 2013)). The importance of clustering sequential patterns in data was already emphasized in (Prinzie & Van den Poel 2006).

IV. RESULTS ON THE SPEED OF SERVICE.

Speed improvements were specifically targeted at finding productivity improvements in the back office and contact center operations. By examining the daily processes of the agents in these environments for one week, an average of a 20% improvement in productivity was discovered for the processes that are involved.

A. Account Balance Service

Customer service agents were examined to understand a number of behavior patterns. A great deal of focus was placed on understanding the link between different service requests placed on the agents, including handoffs, process variations and typical call structures.

While the overall process of a call in general is structured solely based on the customers’ requests, the process is always initiated with an authentication of the customer. Upon examining the process, immediately an interesting finding was made: 88% of all customer calls proceeded directly from authentication to a current account balance. The contact center

system however required several ‘clicks’ for the agent to pull up a current account balance for the customer. As a consequence typically 12 seconds were required to get at this “next step”. Of course, for the customer this is felt as “useless waiting time”...

Working with the application team supporting the call center application, a detailed ROI was constructed based on the costs (application change, agent re-training, etc.) as well as the opportunity (Comprehend provided data on the frequency, and time required). The result was a measurable improvement in call times by immediately providing account balance at the end of the authentication process. The result was an overall 8% decrease in call time.

B. Agent Improvement

During the study, detailed productivity data by Agent by Service were obtained. This allowed for the analysis of Agent performance at a level of detail that was previously impossible. The following picture gives an example of such performance data.

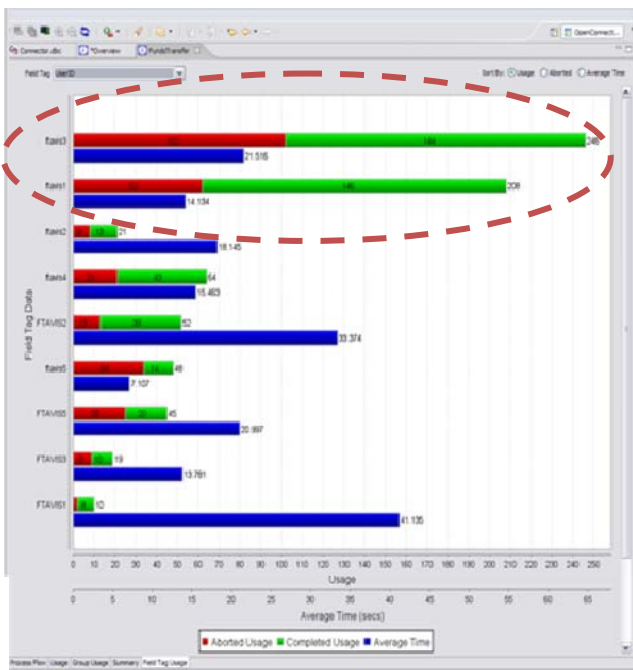


Fig. 2. Time spent in service steps by agent category.

The analysis of the data focused on the average time to process service requests by Agent. The results of this analysis found two immediate areas for improvement:

- One set of agents had acceptable productivity on the majority of the services they provided, however, were found to be struggling on several services. For these agents, a targeted training program was put in place, where with the identification through Business Process Discovery, the agents were pulled out of the line, and provided a short targeted training session on the specific service issues.

- Another set of agents was found to have lower than acceptable productivity over the entire range of services offered. These agents were placed into a broader employee improvement program that included evaluation to overall fit with the job function.

Implementing the targeted agent improvement program resulted in an overall reduction in average call time of 10%.

V. RESULTS ON THE QUALITY OF SERVICE.

Quality was defined on a per-service basis, but generally represented the goal of first contact handling rate (Zbikowski 2007).

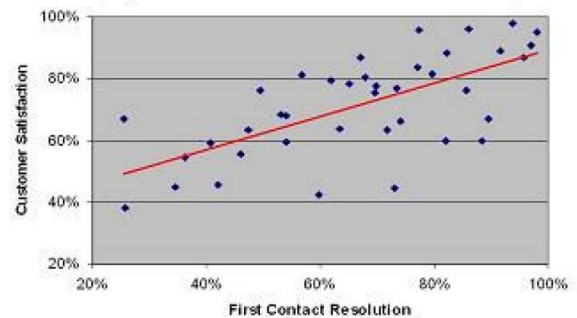


Fig. 3. The impact of First Contact Resolution on Customer Satisfaction.

For example, consider measuring first contact resolution of a change of address request. The request could be originated via a letter/fax sent into back office operations. However, the customer, seeing either no results or erroneous results may subsequently repeat the attempt via any channel, back-office again or a self-service or contact center channel.

A. Change of Address

The change of address service was offered via every channel, and the concern for quality was that the scenario where the customer perceived the service to have been rendered and over the course of time realizes that the address change was not performed correctly.

Automated Business Process Discovery captured every change of address event across all channels and provided the analysis of those events where the same customer had executed a change of address request within two weeks.

Comprehend produces discovered Business Process Models under the form of Hidden Markov Models (HMMs), where the services are the places in the HMMs (Peters et al. 2007). Analyzing the loop for the change of address service in the discovered Process indicated that first contact resolution for change of address was 78%, providing the metric immediately. More importantly, a detailed analysis of the underlying events in the discovered process models allowed gaining insights into the root causes of the change of address failure. By examining the events related to the failed change of address requests, it was discovered that 5-line addresses were disproportionately represented. Drilling deeper into the process, it was found that the entry of 5-line addresses into the underlying systems was a confusing, poorly documented activity.

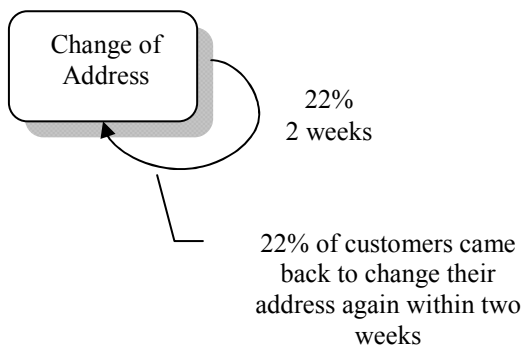


Fig. 4. Drilling down on the details of one particular service.

By simply adding some better documentation to the systems, and brief training to the operations staff, quality was improved over 10% resulting in a 6% reduction in change of address work, and a measurable improvement in customer satisfaction.

B. Self-Service Site Improvement

With over one million unique customer logins to their self-service site daily, the data obtained for this organization revealed that 60% of their over 100,000 calls a day were from customers that were attempting self-service before their call.

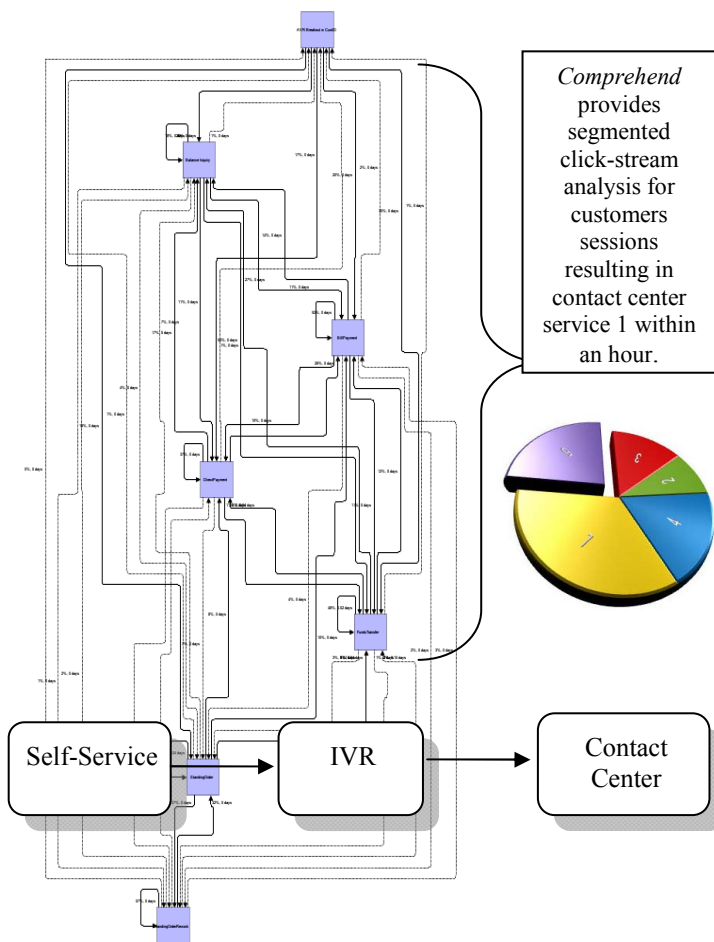


Fig. 5. The high-level customer contact process, showing the details of customer actions before getting to the contact center.

Having 60,000 customers a day failing on self-service was not only keeping customer service agents busy, but also impacting customer satisfaction. Earlier surveys showed that every failure led to a 10% or higher drop in customer satisfaction.

Business Process Discovery connects the dots between the customers' web experience, the ensuing voice recognition session and contact center service to provide invaluable insights into what the customers were really trying to accomplish on the self-service site. The "discovered" models provided the detail on the exact services those customers, who were just on the self-service site, requested from the contact center. This analysis provided a segmented view of the web experience for those specific customers that requested a specific service from the contact center after being on the web. Fig. 5 shows a high-level Hidden Markov Model representation of the click stream behavior for this customer segment. The analysis of this HMM allowed to discover improvements to the online experience to increase the first contact handling rate.

The analysis of the Markov Models allowed for identifying within one month several significant challenge areas. Next, improvements were designed and tested, resulting in a 5% reduction in the calls for those services originating from online customers.

VI. RESULTS ON CUSTOMER CHURN AND CUSTOMER ACQUISITION.

Customer churn has a direct impact on sustained revenue streams. Understanding the root causes for customer attrition also allowed reducing further the costs for customer acquisition, in particular for new services, by providing additional insights in cross-selling opportunities.

A. Leading Indicator of Churn

Through the course of the analysis, the effects of improved speed and quality were expected to have a measurable improvement in customer satisfaction, and thus a carry-on effect on customer churn. However, a more direct analysis of customer churn was also provided to discern patterns of customer behavior preceding the closing of the account.

Business Process Discovery provided the ability to filter customer activity across channels to only look at the interactions of customers that had closed their accounts. By comparing process deviations between the closed account customers and the general population, interesting observations on precursors to account closing were discovered. For example, one such perhaps obvious observation was that customers that ran their account to a zero balance for a billing cycle tended to close their accounts when calling in subsequently. In this case, customers that met this condition were routed immediately to a customer retention specialist instead of the general agent pool.

The results of this analysis provided several observations that led to a measurable reduction in customer churn, resulting in a net 3% decrease in closed accounts.

B. Cross-Sell

Agents were all trained and measured on cross-selling activities to appropriate target groups of callers. Business Process Discovery provided the details on the process followed by successful agents. This is one example of an HMM for the successful agents:

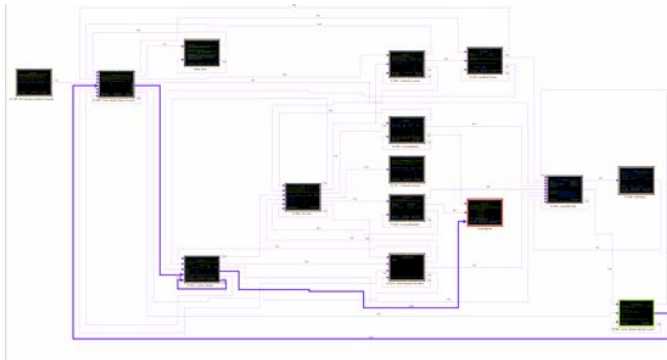


Fig. 6. A Hidden Markov Model for the process followed by successful agents

Best practice was discerned from an analysis of the process details for the best performing agents. This analysis, combined with a training and improvement program for agents not following the best-practice policy, resulted in a measurable 4% improvement in cross-sell affectivity.

VII. SUMMARY OF THE VALUE PROPOSITION THAT WAS REALIZED.

In this case study, the total added value for the Process improvements that were obtained through automated Business Process Discovery, can be estimated to be more than \$13.5M on a yearly basis for the next four years. This combines the achieved improvements in both the back office and contact center operations. These are some details of the value proposition.

- **Quality Improvements (RFT):** automated Business Process Discovery provided the data required to increase Right First Time (RFT) from 75% to 85% (worst case) or 90% (best case) yielding a NPV \$18.0M to \$23.8M of benefit from reduced re-work labor costs over a 4 year period.
- **Cycle Time (Speed):** Process Discovery provided the details on every step performed by every operator for every process yielding the insights to improve process end-end times by 10-25% yielding a NPV \$12.3M to \$24.9M over a 4 year period.

As a result of a reduction in errors and an improved understanding of the processing work, it can be assumed that there are additional opportunities for improvement in customer attrition.

- **Customer Attrition:** Identification of individual customer activity, highlighting preferences and allowing for the tailoring of service provision and resource allocation to suit actual customer behavior yielding a reduction in attrition from 1-2% providing a

benefit of \$7M to \$14M in customer retention over a 4 year period.

In addition to the hard benefits identified during the Proof of Concept, automated Business Process Discovery provided additional soft benefits associated with:

- **Staff Analysis:** Detailed monitoring of operator activity showing actual transaction completion times per staff member, allowing identification of best practice and under-performance, highlighting targeted training opportunities.

VIII. CONCLUSIONS.

“Care-type” services are a serious challenge for data and process mining. Due to the complexity of the two-way interaction, and the variety of circumstances under which the services must be delivered, Business Process improvement studies face the typical managerial problem of “unknown unknowns”. Automated Business Process Discovery provides a basis for a better and deeper understanding of deficiencies in Business Processes. Similar to a CT-scan in healthcare, the automated data collection and analysis through Hidden Markov Models allows detecting root causes for deficiencies and adequate improvement actions. Further research will focus on patterns for deficiencies and improvements, such as the impact of “many-to-many” transitions (Mercado et al. 2012, Peters 2013).

ACKNOWLEDGMENT

This research was made possible in the context of the KU Leuven – OpenConnect Research Chair in Business Process Discovery..

REFERENCES

- [1] Cook, J. E., & Wolf, A. L. (1996). Discovering Models of Software Processes from Event-Based Data, *ACM Transactions on Software Engineering and Methodology*, Vol 7, pp. 215 – 249.
- [2] Houck, C. (2007), Breaking through with Business Process Discovery, *Business Intelligence Journal*, Vol 12 (4), 9 pp. 2007
- [3] Koole G. (2013), *Call Center Optimization*, MG Books, Amsterdam (2013).
- [4] Mercado, C., Dedene, G., Peters, E., Maes, R. (2012), Towards a Dynamic, Systemic and Holistic Theory for Strategic Value Creation in ICT-based Services, in “A Focussed Issue on Competence Perspectives on New Industry Dynamics”, ed. R. Sanchez & A. Heene, *Research in Competence-Based Management*, Vol 6, pp. 153 – 207, Emerald Group Publishing Limited, 2012.
- [5] McAfee, A. (2006), Enterprise 2.0, The Dawn of Emergent Collaboration, *MIT Sloan Management Review*, Vol 47(3), pp. 21 - 28
- [6] Peters, E.M.L., G. Dedene, C. Houck (2007). Hybrid Techniques for Business Process Discovery, *Proceedings of the INFORMS Annual Conference 2007*.
- [7] Peters, E. M., & Dedene, G. (2011). Business Process Discovery & Workforce Intelligence Techniques in Healthcare, *International Journal of Health Management and Information*, vol. 2, no. 1, pp. 25 - 39.
- [8] Peters, E. (2013). *Discovering Value Leaks and Service Imperfections in Business Processes*, Ph. D. thesis University of Amsterdam, 2013.
- [9] Prinzie, A. & Van den Poel, D. (2006), Incorporating sequential information into traditional classification models by using an

element/position-sensitive SAM, Decision Support Systems, vol. 42, no. 2, pp. 508 – 526.

[10] Triplett, J. E., Bostworth B.P. (2000). Productivity in the Services Sector, American Economic Society, 26 pp.

[11] Viaene, S., Van den Bunder, A.,(2011), The secrets to managing business analytics projects, MIT Sloan Management Review, Vol. 53(1), pp 65 – 69

[12] Zbikowski E. (2007). The Essential Call Center KPIs, International Customer Management Institute white paper, April 2007, 9 pp.