

The Quest for the Comprehensive Customer Journey - A Case Study from a C2C Marketplace

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Abstract. Bookis is a C2C online marketplace for physical books. It is a product-orientated platform on web and mobile apps that enables customers to buy used books from other customers on the platform. Insights into the customer behavior and how customers experience their customer journey is crucial to improve their marketplace. Service providers, such as Bookis, are accumulating more and more data from their systems that could be leveraged for analysis. Yet, turning such data into comprehensive individual customer journeys is a significant challenge. This difficulty is compounded by several issues among which: (1) converting or connecting raw events to discernible touchpoints, (2) defining the boundaries of journeys in a C2C marketplace, and (3) acquiring and integrating data from external service providers such as delivery services. We provide a case study describing two analysis iterations in an attempt to obtain a comprehensive view on Bookis' main customer journey by combining an "outside in" view (mystery shopping) with an "inside out" view (process mining). We leverage a novel event knowledge graph approach to data integration and conclude that the combination of both viewpoints is important to obtain a comprehensive analysis of the customer journey. In particular, relevant parts of the journey may not be covered by data-driven method, despite the large amounts of event data available.

Keywords: customer journey · mystery shopping · process mining.

1 Introduction

Service provisioning has expanded significantly over the past few decades, and today, our society is dominated by services. Private and public service providers are challenged by the fragmentation of service systems, a growing number of customer channels, and customer-to-customer (C2C) interaction through social media [11]. It has become increasingly complex for service providers to assess service quality. We provide a case study that investigates the services of Bookis, a complex C2C service, through the lens of customer journeys and process mining.

Bookis is a service provider in the circular economy sector that provides a C2C online marketplace for physical books. Shipping and payment are integrated

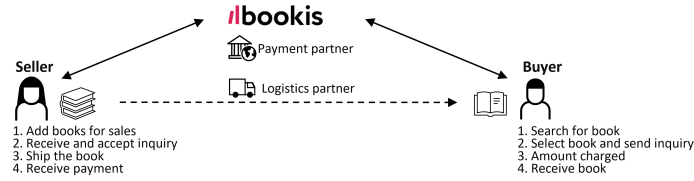


Fig. 1. Overview of the Bookis service system.

into the buy-and-sell flow. Also, there is an option for both the buyer and seller to donate royalties directly to the author, and authors can sell books directly on the platform. Hosted on Amazon Web Services, Bookis is built natively on mobile apps and websites. Traditionally such a marketplace would only facilitate so that buyers and sellers could find each other. Today, most marketplaces have switched from “unmanaged marketplaces” to “managed marketplaces” resulting in becoming transactional with integrated payment and shipping. Bookis provides such transactional service integrating with external service providers for shipping and payment. Besides Bookis, the service delivery network consists of a payment provider and several logistic partners.

Central to the service design of the product-oriented marketplace is the product page. It allows Bookis to facilitate the service experience for the buyer. For example, among many sellers, one of them will be highlighted as the recommended seller for you as a buyer depending on an algorithm that considers your profile and shopping basket. This can increase the number of books being bought in every transaction and benefits both sellers and buyers by increasing the sales for highlighted sellers and reducing shipping costs for buyers. In summary, Bookis is a prime example of a complex service design in which their own services are integrated with external services providers and the part of the services enacted by the users, seller and buyer, themselves. Fig. 1 shows the main steps involved when selling and buying books.

The main objective of our research is to improve the understanding of the *benefits* as well as the *limitations* of traditional customer journey analysis methods and process mining methods along with their *combination*. In principle, traditional observation methods (observation, mystery shopping) provide a comprehensive “outside-in” view on a customer journey using a small sample. In contrast, process mining provides an “inside-out” view, i.e., the source of information are the organizations information systems, and is data-driven so that it can leverage a large sample of all available event data. Thus, the combination of both methods seems to be promising and complementary.

In fact, it can be difficult to holistically capture the user experience with process mining alone [16] since not all aspects of the journey are recorded. Conversely, a small sample observation or mystery shopping study may be biased through the sampling approach and fail to provide the large-scale analysis provided by process mining. It also may fail to connect the external observations to the internal processes of the organization. We are not aware of published

studies that systematically combine both approaches, even though a dual view on customer journeys seems crucial to understand all aspects of a customer's journey. In our study, we encountered several challenges when mapping events to the customer journey domain concepts which led us to propose a new data format. We also contribute lessons learned on combining both approaches.

In the remainder of the paper, Sect. 2 describes the problem addressed, provides background on both methods and the case study execution. Then, the results are summarized in Sect. 3, and Sect. 4 concludes with the lessons learned.

2 Case Study

The aim of our case study was to obtain a comprehensive view on the core customer journeys for the Bookis marketplace from a customer perspective. For Bookis the value of such analysis is to avoid blind spots in their understanding of how customers perceive their services. It is also relevant to understand both the nuances of how individual journeys were performed as well as a birds-eye-view on multiple journeys and how multiple journeys connect to each other. Next to the business value, we set out to understand how the available event data on such customer journeys with multiple service providers and multiple customer roles (buyer, seller) can be effectively integrated into a single representation of the customer journeys.

In the Bookis marketplace there are two main journeys (Fig. 1) depending the role of the user acting as seller or buyer. Bookis describes them as follows:

- **Adding books for sale (J1).** With a mobile app, the seller scans the barcode on the book, obtains all the metadata, which prefills the details. The seller needs to only specify the price and condition and can add a book for sale in 15 seconds.
- **Buying books (J2).** With the mobile app or in a browser, the buyer finds a book or multiple books and sends a request to the seller. The seller receives a push/email/SMS about the book(s) the buyer wants to buy and can then accept or decline the request.

When conducting the analysis, we focused on J2 as it is a more complex journey than J1 involving multiple service providers as well as the buyer and the seller. It is also the main revenue-generating journey.

To comprehensively analyze the buying book journey (J2) and investigate our research objectives, we followed a procedure in which we combined a mix of the customer journey analysis (qualitative and quantitative) as well as process mining (quantitative) that gives rise to a proposed generalized procedure and enabled us to collect the challenges encountered during the study execution and provide the lessons learned reflected on later. In the following Sect. 2.1 and Sect. 2.2, we describe our method of switching between an "outside in" and an "inside out" perspective and solutions for some of the challenges. Later in Sect. 3 we summarize the results and the problems that remain open.

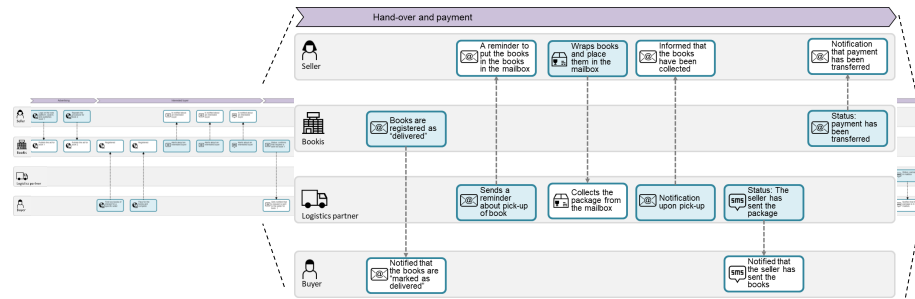


Fig. 2. Zoomed-in segment of the combined journeys for the seller and buyer on Bookis represented as CJML. The entire journey consists of four phases and 27 touchpoints.

2.1 Outside-in perspective

Customer journeys emerged from marketing and customer-centric thinking and has become a strategic tool to help identify issues within current services, design novel services, and assess customer behaviors and experiences [10]. Journey maps are diagrams that chronologically depict the customer's steps or touchpoints. However, journey maps vary in definition, detail, and abstraction. In this paper we use the Customer Journey Modeling Language (CJML) which defines a journey as a sequence of touchpoint involved for a user to achieve a specific goal in the context of a service process [7]. CJML allows for a precise modeling of individual customer journeys from the viewpoint of the customer ("outside in") and the comparison of these against the service delivery process as planned [13].

We take a look at an example of CJML representing a combined customer journey for the seller and buyer of books using Bookis as service provider. Fig. 2 shows the combined journeys using CJML. We highlight a segment of the hand-over phase to provide an example of the notation. Please note that the CJML diagram in Fig. 2 represent a single actual customer journey which not necessarily complies with the planned ideal journey.

The seller, the service providers, and the buyer appear in separate swim lanes containing their respective touchpoints (nodes). It is assumed that the seller and buyer already have user accounts, and the payment partner is integrated with Bookis. First, the seller, Jane, prepares the books for sale and lists them on the platform. This involves logging into the platform, searching for the appropriate categories, and publishing ads for each book. The buyer, Mike, browses the platform and identifies two books of interest. Upon finding suitable books, he requests to buy them, and payment is reserved on his card. Jane receives notifications and accepts the purchase requests through a link provided via email. Once Jane accepts the requests, Mike is notified by Bookis. Interestingly, the system already "marks the books as delivered" even though the logistics partner did not yet receive them from Jane. This appears as inconsistency in Fig. 2 but corresponds to the actual journey at that time. In due time, the logistics partner reminds Jane to prepare the books for pick-up. Jane wraps the books,

marks them with reference codes, and places them in the mailbox for pick-up. The logistics partner collects the books from Jane’s mailbox and updates the platform about the pick-up status, notifying Mike that the books are on their way. At this point, the money is withdrawn from Mike’s card and transferred to Jane. Mike is kept updated on the expected delivery time and is finally notified when the books are safely delivered to his mailbox.

In the case study, the outside-in perspective was initially explored through service walk-throughs using both PC and mobile app. Following this initial exploration, we applied the mystery shopping method, where researchers took on the roles of seller and buyer, completing the entire transaction process on the C2C platform. In total, five journeys were completed and documented using CJML to cover the use of different end-user devices and the comparison between browser and app usage. A second round of mystery shopping was conducted 9 months later. In this round, two buyer and seller journeys were paired, with two books being purchased at a time. This approach enabled a comprehensive assessment of the customer journey from the outside-in perspectives of both buyer and seller within the same context.

2.2 Inside-out perspective

In the digital era, most touchpoints within customer journeys generate numerous events that can be leveraged for process mining [1] as proposed in the literature [2]. Process mining reverse engineers a process by leveraging the recorded events from information systems to infer the as-is process behavior [1]. Several applications of process mining for analysing user journeys have been reported. For instance, web log analysis [14], and service delivery improvements [8]. Bernard and Andritsos [2, 3] were among the first to apply process mining for understanding customer experience. Their approach took a customer-centric approach and attempted to consider contextual information, e.g., customer emotions and characteristics into the analysis. In [14], insights into the user behavior are rendered but external factors beyond the web logs that could influence the user behavior are not considered. More importantly, the actual user experience at each of these steps is not considered. Hansson et al. [8] presented a comprehensive mapping of a real-life customer journey using process mining and also performed a qualitative analysis. However, the journey analyzed was very simple on a small sample. Recently Zilker et al. [16], noted that a holistic and customer-centered analysis for process mining would be important for service analysis and recognized such a holistic view of an end-to-end customer journeys with all the steps, various systems and user experience as challenge. In [6] it was also reported that the relationship between atomic events recorded by various systems and a single touchpoint in the journey on the abstraction level of CJML may be complex and multifaceted. Also, event data may need to be raised to a higher abstraction level [15], refer to multiple actors (the service provider’s employees, the customer), be related to customer experience, and spread over multiple organizational units or organizations.

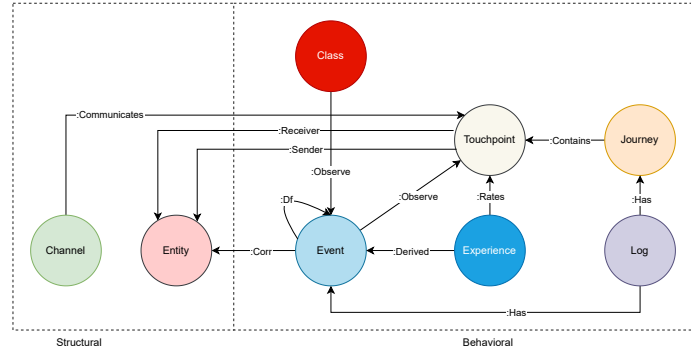


Fig. 3. The extended event knowledge graph schema based on the proposal in [4]. Each of the circles depicts a node type and each edge a relationship type.

For the process mining part of the analysis, we extracted data from Bookis systems supporting the mobile application and website using both database records as well as tracking logs. The multi-faceted nature of the events described by prior work is also recognizable in our case confirming the suggestions of prior work. Events refer to several different actors who can switch roles (buyer, seller) and belong to different organizations. In fact, the data extraction took place after the initial round of mystery shopping, which was crucial to mapping the various technical events to user-facing touchpoints. The data validation with the "outside-in" perspective also led to a repeated extraction complementing the dataset with parcel tracking events from the shipping provider.

To retain the flexibility of investigating the event data from multiple perspectives and to be able to connect the extracted events with CJML domain concepts, we decided to use an Event Knowledge Graph (EKG) [4] representation. An EKG is a recently proposed model that was designed to represent such multi-dimensional or multi-entity event data in a flexible and extensible graph representation. To extend the EKG with CJML domain concepts, we enriched its schema as shown in Fig. 3. An EKG is a graph consisting of nodes and relationships between nodes. In Fig. 3, the possible node types are represented as circles and the possible relationships between nodes of a certain type are represented by labeled edges. The basic EKG schema proposes to use *Entity*, *Event*, and *Class* nodes. Events are of a certain event class and may relate (*:Corr*) to multiple entities and a directly-follows relation (*:Df*) local to each entity can be constructed such that two events are related by *:Df* when they are directly following and relate to the same entity.

We model the different service providers and end users from CJML as entities since this allows us to view the recorded events from their viewpoint. We decided to further extend the basic schema with the other domain concept of CJML. *Touchpoint* nodes can group events that were observed during a touchpoint and relate to communication *Channels* through which the participating parties

Table 1. A simplified listing of the buyer journey (J2) touchpoints.

ID	Time	Description	Initiator	Receiver	Channel
T1	Day 1	Searches and selects two books	Buyer	Bookis	web/app
T2	Day 1	Pays for the two books	Buyer	Bookis	web/app
T3	Day 1	Request sent to seller for book 1	Bookis	Buyer	e-mail
T4	Day 1	Request sent to seller for book 2	Bookis	Buyer	e-mail
T5	Day 1	Seller accepts the request for book 1	Bookis	Buyer	e-mail
T6	Day 1	Seller accepts the request for book 2	Bookis	Buyer	e-mail
T7	Day 1	Notification: Book 1 marked as "delivered"	Bookis	Buyer	e-mail
T8	Day 1	Notification: Book 2 marked as "delivered"	Bookis	Buyer	e-mail
T9	Day 3	Seller has sent a package	Logistics	Buyer	SMS
T10	Day 11	Package delivery next day	Logistics	Buyer	e-mail
T11	Day 12	Package is delivered to mailbox	Logistics	Buyer	SMS

(*Entity*) receive and send. Since touchpoints always relate to a single journey, we also included the *journey* as separate node type. For future use, we also included a dedicated node type to capture customer experience. Please note that whereas we validated the proposed extension only with the Bookis case the extensions are based on the generic CJML concepts, which have been shown applicable in several other domains [13] having service processes such at least telecommunication [5] and healthcare [7].

For the case study, we used Neo4J as graph database and developed a Python tool to load the extracted events from a JSON format into the EKG following our propose schema. Based on the EKG, we reviewed several of the actual journeys using the built-in graph visualization of Neo4j Browser as enriched directly-follows graphs. The goal was to understand the challenges in connecting event data to the customer journey as perceived by the customer and to assess which further insights a process mining view on the journeys could provide.

3 Outcomes

We followed both two methods as described in Sect. 2. This led to two main analysis iterations for which we now summarize and reflect on the outcomes.

3.1 Outcome of first analysis iteration

Previous studies show a lack of comprehensive overview of the customer journeys [12], particularly during the handover to partners in the service delivery network [5]. The systematic investigation of the outside-in perspective by using CJML and mystery shopping provided new insights for Bookis. By concretizing and visualizing the seller and buyer journeys, along with structured feedback, Bookis gained a more detailed view of the entire customer experience. This process clearly highlighted both barriers and positive experiences.

It became evident that several aspects required immediate attention, particularly substantial back-end changes. These issues were promptly addressed, with a focus on enhancing product stability and streamlining processes. Additionally,

the findings corroborated some previously identified problems. The following improvements were initiated:

- Ensure all sellers can use the shipping and payment solutions
- Improve search functionality for relevance and availability.
- Simplify communication via email and SMS
- Review and streamline integrations, such as preventing premature delivery notifications (cf. Sect. 2.1 and T7 and T8 in Table 1).
- Reassess key customer journeys and communication, aiming for clearer and more concise explanations.
- Ensure listed books are actually available for sale and sellers are active.
- Address various other minor issues to enhance the customer experience.

The initial data collection amounted to a bit more than 25 000 events out of which about a bit more than 3000 events were related to some of the touchpoints identified. Table 1 shows the sequence of touchpoints that were identified for one of the mystery shopping journeys. Whereas we could successfully obtain events for T1-T8 from the Bookis system, the analysis revealed blind spots in the data recording. Events from the shipment provider data could not yet be accessed at this stage, which prevented an analysis of the final phase of the journey, i.e., for T9-T11 in Table 1 we were not able to use process mining.

3.2 Outcome of second analysis iteration

The second round of analysis revealed additional areas for improvement. Some issues were relatively easy to address, such as textual changes in notifications. For example, the message sent to buyers stating, "the book is marked as delivered in our systems," required more customer-oriented language. This was particularly important since the buyer was notified that the book would be shipped from the seller two days later. Both the content and timing of this touchpoint needed Bookis' attention. Another issue requiring back-end work was the number of notifications sent when purchasing multiple books. Many touchpoints are sent "per book," causing the total number of touchpoints to grow linearly with the number of books purchased. This overload of touchpoints distracts the buyer from important messages. Additionally, the seller could be notified when the payment is received in their bank account, and when the books have arrived at the buyer's address.

Finally, we revised the data integration to also include events provided by the shipment provider. This yielded a more complete view on the journey as visible in the subgraph shown in Fig. 4. Currently, we are working at aggregating several similar journeys to a multi-entity directly-follows graph providing indications on frequencies and performance. Also, several events that are not directly connected to the touchpoints but may be relevant to the context of the journey, e.g., user navigation in the mobile application, are already added to the EKG but not yet considered for analysis. However, the EKG already provides us with the explicit directionality of the communication through the touchpoints, connecting the

experience about a touchpoint. This would be a prerequisite to enable the analysis, prediction and, ultimately, improvement of the user experience based on event data. However, automatically obtaining high quality data on actual user experience is challenging.

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References

1. Aalst, W.v.d.: Process mining: data science in action. Springer (2019)
2. Bernard, G.: Process-Mining-based Customer Journey Analytics. Ph.D. thesis, University of Lausanne (2020)
3. Bernard, G., Andritsos, P.: Cjm-ex: Goal-oriented exploration of customer journey maps using event logs and data analytics. In: BPM (Demos). CEUR Workshop Proceedings, vol. 1920. CEUR-WS.org (2017)
4. Esser, S., Fahland, D.: Multi-dimensional event data in graph databases. J. Data Semant. **10** (06 2021)
5. Halvorsrud, R., Kvale, K., Følstad, A.: Improving service quality through customer journey analysis. J. Serv. Theory Pract. **26**(6), 840–867 (2016)
6. Halvorsrud, R., Mannhardt, F., Johnsen, E.B., Tarifa, S.L.T.: Smart journey mining for improved service quality. In: SCC. pp. 367–369. IEEE (2021)
7. Halvorsrud, R., Sanchez, O.R., Boletsis, C., Skjuve, M.: Involving users in the development of a modeling language for customer journeys. Softw. Syst. Model. pp. 1–30 (2023)
8. Hansson, M., Angel, K., Mannhardt, F., Kvale, K.: How can a service provider utilize process mining on customer journeys to gain actionable insights for service delivery improvements? In: BPM Industry Forum. CEUR Workshop Proceedings, vol. 3112, pp. 15–26. CEUR-WS.org (2021)
9. Kobialka, P., Mannhardt, F., Tarifa, S.L.T., Johnsen, E.B.: Building user journey games from multi-party event logs. In: ICPM Workshops. LNBIP, vol. 468, pp. 71–83. Springer (2022)
10. Lemon, K.N., Verhoef, P.C.: Understanding customer experience throughout the customer journey. J. Mark. **80**(6), 69–96 (2016)
11. Ostrom, A.L., Field, J.M., Fotheringham, D., Subramony, M., Gustafsson, A., Lemon, K.N., Huang, M.H., McColl-Kennedy, J.R.: Service research priorities: managing and delivering service in turbulent times. J. Serv. Res. **24**(3), 329–353 (2021)
12. Rawson, A., Duncan, E., Jones, C.: The truth about customer experience. Harv. Bus. Rev. **91**(9), 90–98 (2013)
13. SINTEF Digital: Resource site for CJML. <https://www.cjml.no> (2022)
14. Terragni, A., Hassani, M.: Analyzing customer journey with process mining: From discovery to recommendations. In: FiCloud. pp. 224–229. IEEE (2018)
15. van Zelst, S.J., Mannhardt, F., de Leoni, M., Koschmider, A.: Event abstraction in process mining: literature review and taxonomy. Granul. Comput. **6**(3), 719–736 (2020)
16. Zilker, S., Marx, E., Stierle, M., Matzner, M.: Process mining for advanced service analytics - from process efficiency to customer encounter and experience. In: HICSS. pp. 1–10. ScholarSpace (2022)