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Datum based Event Mining: the case of Customer Experience in Insurance

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***Abstract*— To face deep changes of Insurance market, French Mutual Health-Insurers (FMHI) have to improve their Customer Experience Management (CEM). CEM is based on Customer Experience (CE) analytics. Our paper explores issues observed throughout collaborative workshops focused on designing CE. Marketing executives lead those and utilize Customer Journey Application (CJA) to analyze CE. In our case, journey visualizations created with CJA are decontextualized. That problem comes from raw interactions (customer's single contact) used and obtained through FMHI's information system. We propose to enrich CJA with massive and contextual data (Datum) whence customers' interactions emerge. Our contribution here is to improve interactions' sequences visualizations (Trajectories) for marketing executives. That is made possible through the use of Classification and Event Mining techniques. The combination of those techniques allows offering new qualitative analytics on CE.**

Keywords*— *Customer Experience Management, Customer Journey Application, Context theory, Datum, Service interaction, Event Mining

I. Introduction: From Designing to Discovering Customer Experience

Our paper relies on the case of a mutual health-insurer (MHI), the third one in France. The French health-insurance (FHI) market is completely transforming. The number of MHI dropped from 1158 in 2006 [1], to 446 in 2016 [2] and 421 in 2017 [3]. Many factors are involved in this process. Regulatory constraints upset market's rules. More and more aggressive non-mutual health-insurance actors enter in this market. Lastly, the need for customer personalization grows up. Thus, offering relevant and omnichannel customer experiences is becoming both a necessity and a strategy for MHI. In this context, improving its understandings of customer experience is a prerequisite to succeed. Nevertheless, insurers face analytical difficulties to obtain correct insights in order to offer omnichannel and personalized services.

About Customer Experience, [4] depicts the experiential views of consumer behavior through three concepts - "fantasies", "feelings and "fun. [4] define those concepts as "the fascinating and endlessly complex result of a multifaceted interaction between organism and environment". Then, [5] emphasize the "experience economy" as the furthest step of the evolution of the economic value. [5] claim that "an experience occurs when a company intentionally uses services as the stage, and goods as props, to engage individual customers in a way that creates a memorable event." Finally, [6] synthetize multiple authors' definitions to define customer experience as "the interaction between a person and a consumer object within a given situation. The interaction is both a process and a result. Interaction leads to a coproduction event between a customer and an enterprise which could be pleasant, memorable and sense-making. The customer may benefit from this interaction and could enthusiastically promote it via word-of-mouth and may wish to repeat in future". Regarding these definitions, our main hypothesis here is the misunderstanding of customer experience paradigm. Current insurer's practices focus on designing Customer Experience from an Idealistic point of view. That design is based on expertise and quantifications arose from Customer Journey Application (CJA). Accordingly, it predetermines what customer journey should be. Our hypothesis is that customer journey has to be discovered from a datum (contextual data) with event mining techniques. Then, we are able to discover and analyze Customer Experience from a Pragmatism point of view. Datum is a term, which comes from organic philosophy (A.N. Whitehead), to show the different variants of information possessed by Actual Entity (in our context Actual Entity is a synonymous of Event).

Accordingly, this paper's research topic is to define how to improve Customer Experience Analytics through CJA including multifaceted interaction, customer engagement and situation.

In the first section, we will analyze Customer Experience Analytics issues within MHI practices. The second section will introduce our theory for Customer Experience management. Within the Contextualizing Artifact relies on trajectory concept and service interaction pattern. The latter tries to reduce Customer Experience Analytics issues. The third section will discuss how to use Contextual data (Datum) and event mining techniques to reach desired insights. Finally, this article will conclude on our perspectives and our work challenges.

II. Issues in Current Customer Experience Analytics

For four months (November 2017-February 2018) we conducted fifteen exploratory interviews. Interviewees came from various insurer business units – Product Development, Marketing & Sales, Policy Administration, Customer Management and IT – and different levels of hierarchy – strategic, management, executive and experts. Each interview lasted one and half hour. All have been transcribed. This process and literature review [7] [8] have confirmed and specified our hypothesis:

- Customer Experience is a strategic aspect of business transformation and have relevant digital dimension;

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- Customer Journey is the construct used by marketing and customer relationship executives to understand Customer Experience;
- However one of the major problems is to consider this phenomenon beyond its marketing dimension, especially when it concerns linking customer segments and journeys, grasped outside of dynamics and situated engagement or interaction notions.

In conjunction with these, we studied health-insurers experts' practices which deal with Customer Experience Analytics using CJA. In first instance, they established a clear separation between *Customer Experience, Customer Journey and Customer Process* (Fig. 1).

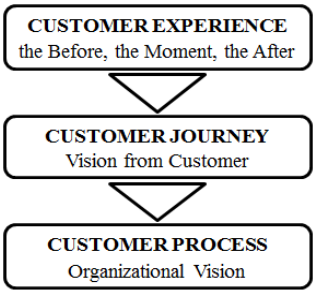

Fig. 1. Customer Experience Management definitions

Customer Experience defines customers' point of views of all interactions lived and fostered with the brand. Point of view could be before, at the moment, or after the interaction. Customer Journey is composed of all steps – interaction moments – occurring when the customer endured a relation with the brand selling, using or relational exchanges. Customer Process regroups all invisible activities to the customer that companies performed throughout their business process and with IT tools.

We compared these specifics definitions with [9]. A similar distinction is made between Customer Experience and Customer Journey. Nevertheless [9] claimed: "Customer Journey is the enterprise prescribed vision of the customer trajectory within a chronologically given touchpoint organization". Accordingly, Customer Journey could be designed in the same way that IT artifact. Thus, the creation of an artifact answering the complexity of Customer Experience handling in digital environment is a relevant approach. This artifact aims to design at designing cross-channel Customer Journey which develop managers' capabilities and help them reduce the complexity of customer experience management.

Throughout attended workshops of Customer Experience designing, also described by [10], we identified executives' practices and IT tools used. Marketing executives try to categorize and quantify journey touchpoints whether as "enchanting" or "irritating" relying on customers' interactions. They make that categorization by using an IT tool: DataKili© [11]. However, results were not harnessed mostly because of the restricted vision of interaction concept utilized. Neither organizational response nor customer satisfaction was addressed while using that tool. Thus, Customer Experience Analytics are not useful to design proper customer journeys.

To summarize, we identified two issues regarding Customer Experiences Analytics based on CJA. Number one: restrict CJA as a quantification tool for interactions. Depending on experts, Customer Journey artifact as a visualization tool is an admitted mean to Customer Experience management. Nevertheless, insights have to be situated within a customer trajectory. Issue n°2: the data utilized. Executives' practices exploit: unique anonym customer identification, types of interaction, channels and motives stored in a relational database. There are no datum (contextual data) from which emerge interactions. CJA just use 'decontextualized interactions'. Building on that, in the next section we define our artifact to grasp Customer Experience complexity based on Design Science Methodology [12] – the "Contextualizing Artifact" – which is grounded on engagement [13][14] and trajectory [15] concepts, together entangled through a consistent "context" apparatus.

III. A NEW FRAME FOR CUSTOMER EXPERIENCE

A. *Customer Experience through Context-System-Trajectory Theory*

Since November 2017, coupled with our works on Customer Experience Management, we developed a new theory to grasp Customer Experience beyond its marketing dimension. We have given it the name of Context-System-Trajectory theory (CST). Within, our Contextualizing Artifact is grounded (Fig. 2).

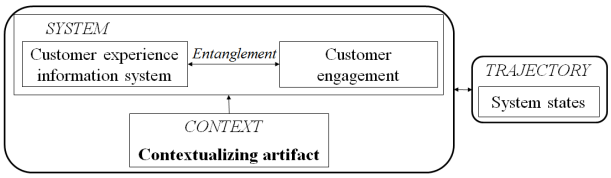

Fig. 2. Context-System-Trajectory (CST) Theory

In accordance with our previous works and publications, Contextualizing Artifact rests on a double hypothesis:

- customer experience information system and consistency activity journeys constitute one single process, according to imbrication perspective [16], the "intra-action" theory [17], and the entanglement and information system sociomateriality [18][19][20];
- the System/Trajectory pattern makes Context the joining element between System and Trajectory. So, our contextualized artifact could be positioned within the triplet Context/System/Trajectory concept also call CST theory. Context could be understood through elements which act directly on the experiential trajectory' building.

Contextualizing Artifact represents a complete model. The complexity of this construct implies to shape it step by step. Therefore according to Design Science Methodology [12] we build a *method*. It tries to address Customer Experience Analytics issues by capturing context surrounding customer journey.

In order to build this method we focused on the trajectory concept. Trajectories represent the different states of a "system" or object that we have to observe. What is observed here is the Customer Experience Information System

entangled with Customer Engagement Journeys. Then, the Contextualizing Artifact is the experimental apparatus used to characterize the state of the system. According to [21] analyzing trajectory implies characterizing ingredients. Ingredients are "context elements which act on project's trajectory" [21, p.85]. Accordingly, trajectory and context are conceptually linked. Trajectory concept stands at the intersection of interactionism [15], contextualism [22] and processualism [23][24]. Trajectory's notions have been defined as follow by [21]:

- context: is the set of elements present in a situation ;
- ingredient: refers to context's element identified by the researcher or the analyst as acting on specific project or system trajectory;
- engine: stands for ingredients movement and assembling generative mechanism during a trajectory;
- sequence: is the trajectory temporal segment which articulates an ingredient set following a significant disposition;
- turning point: the trajectory temporal segment characterized by an intense ingredients disposition reconfiguration leading to a change of trajectory orientation.

Those concepts allow analyzing regular movements within a trajectory as well as its brutal reorientation or turning point. We consider these definitions as a starting point making trajectory concept relevant as "system states" (or event). Thus to improve CJA and finally Customer Experience Analytics we focus on the "System" component of CST theory. This component consists in two main sub-components that have to be considered as entangled: Customer Experience Information System and Customer Engagement. These components' main function is to define customer journeys aligned on MHI strategy.

Our analyses of System's implementation revealed three configurations. The first one: separate systems, they are a major issue clearly identified. They provide predefined journey within one channel but no vision of the whole Customer Journey. The second one: systems named Customer Engagement Hub (CEH) which is a new interaction retention system. MHI try to implement them. According to Gartner 2017 definition, CEH "is an architectural framework that ties multiple systems together to optimally engage the customer. A CEH allows personalized, contextual customer engagement, whether through a human, artificial agent, or sensors, across all interaction channels. It reaches and connects all departments, allowing, for example, the synchronization of marketing, sales and customer service processes" [25]. Last configuration: omnichannel context-awareness information systems (smart contracts, collaborative insurance, micro-insurance) that are actually too abstract ideas for MHI actors.

Therefore, to deal with Customer Experience Analytics issues we decided to utilize CEH recent approaches. As mentioned in section 2, anonym customer identification, types of interaction, channels and motives are already stored in a 'kind of' CEH. That, does not offer the capability, neither to take into account real-world customer' situations, nor the ubiquitous and pervasive computing systems that customers now daily use inside these situations. That scenario does not allow to fully addressing datum concept. Thus, we propose to analyze system state through service interaction concept. This concept implies customer and employee having to work together in order to achieve a mutual understanding to get the task or service done. As [26] notes: "interactive service work is inherently characterized by uncertainty concerning the outcome or result of the interaction" [26, p. 6]. Thus, they are vivid and performative human interactions which take place between prospects or clients and front-line or back-office service workers. So in order to address CEH current limitations and identify relevant contextual data, service interaction is appropriate because of its compatibility with trajectory concept. Consequently we tried to settle a computable service interaction model as a pattern for process mining.

B. Analyzing Customer Experience System with Service Interaction Model

We propose to use context theory to investigate service interaction concept. Context is the information used in a model for representing real-world situations, whereas, situations are represented as a meta-level concept over context [27]. Henceforth, the "context" of the contextualizing artifact - articulation of trajectory and service interaction - is distributed information from situations and their interactions, at a service systems level of abstraction.

It is why we propose to catch the context of our Contextualizing Artifact – situation's service interactions – from an expanded version of Interact-Serve-Propose-Agree-Realize (ISPAR) model of service systems episodes or sequence of events. Within, a series of activities are jointly undertaken by at least two service systems and produce ten possible outcomes [28]. For example, in ISPAR model, realization of the proposed and agreed service is the desired outcome of a service system (outcome R). But a proposal may not be successfully communicated or understood by other service systems (-P), and so the interaction may be aborted. Secondly, a proposal may be communicated, but activities between the service systems may not lead to an agreement (-A), and so the service interaction may also be aborted. A case of particular interest is when an interaction (I) between service systems is not service interaction (-S), but nevertheless the interaction may be welcomed by both service systems. Here, welcomed (W) non-service interactions should not be minimized, they often lay the foundation for future service interactions that may co-create great value.

Despite its relevancy to represent service interaction, ISPAR model have to be adapted to help Customer Experience executives characterize customers' real-world situations characterization. Thus we propose NISPARO model (Fig 3.) as an extension of ISPAR model, as main component for our Contextualizing Artifact and as foundations of our new kind of analytics. With New Event (N), we are capable to understand how an interaction and maybe a service interaction are triggered. With Outcome (O), we should be able to provide analytics on activities that customers have achieved (or not achieved, –O) through the realization of the service interaction.

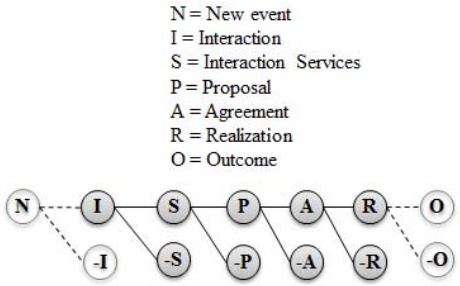

Fig. 3. NISPARO Model

In brief, we propose to use an adapted service interaction pattern, called NISPARO, to design the first step of our Contextualizing Artifact's component. Its purposes are (1), to enable the utilization of the Datum throughout new sets (contextual data) and, (2) to characterize interactions at a service system level – service interaction or sequence of events – relying on CEH systems. That is our model to enrich CJA with mining techniques as event mining technique. Accordingly, Customer Experience Analytics integrate multifaceted interactions, customer engagement, and situations. In section 4, we will discuss about our model integration in Customer Experience Information System including new datasets and possible techniques to execute event mining.

IV. Customer Experience Contextual Insights

A. Solution Overview

In order to explain how new datasets (representing Datum) will be utilized to compute NISPARO with event mining techniques, we discuss about its integration within customer experience information system.

This information system ecosystem (Fig. 4) currently exists within our studied MHI. White elements are those existing whereas, grey ones are added or modified regarding our work. Here, we try to improve Customer Experience Analysis business process that marketing executives accomplish (Business Process component: Customer Experience Analysis).

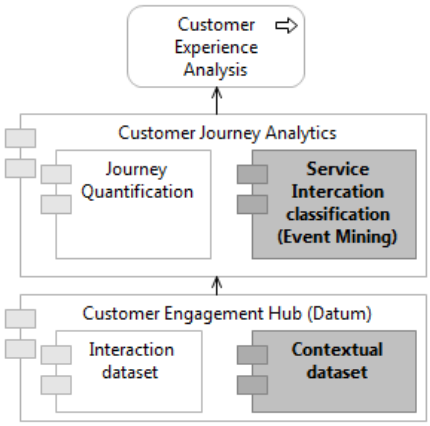

Fig. 4. Customer Experience Information System (partial)

A Customer Journey Application supports this process and its analytical tasks (Application component: Customer Journey Analytics).

Customer Journey Analytics Application is composed of two components. The first exists and is used to quantify Customer Journey touchpoints (Application Component: Journey Quantification). The second will be created within our work (Application Component: Service Interaction Classification) and discussed in detail in paragraph B.

Customer Journey Analytics application relies on an existing enterprise data management system (Application Component: Customer Engagement Hub, CEH) representing Datum concept. It is also composed of two sub-components named datasets here. Interaction Dataset exists (Application Component: Interaction dataset) and stores all customer interactions in the form of a quadruplet: Person, Interaction type, Interaction channel, Interaction Motive. Each interaction has unique anonym identification and a timestamp. We will add a new component to Customer Engagement Hub: Contextual dataset (Application Component: Contextual Dataset). It aims to store new data type needed by Event Mining techniques. We will utilized them to classify an interaction as an interaction service status regarding NISPARO pattern. Here, both datasets are fully anonymized in order to be compliant with security and privacy regulations.

B. Contextual Dataset use

Firstly, we will describe the Contextual dataset application component. It will contain situations' contextual data from realized interactions; those are associated to service interactions. As explained this dataset will complete Interaction dataset which is customer-centric. Within, link to customer identification we access all its interactions (motive/channel/timestamp).

As explained this dataset will complete Interaction Dataset which is customer-centric. In the latter, through hashed customer identification, we should access all interactions of a customer (motive/channel/timestamp) and some of its anonymous properties (age group, state). The last data type available within Interaction Dataset is health-contract (product type, guarantees) information. All of these data are crucial for our works but they are not sufficient.

Accordingly, we aim to constitute the Contextual Dataset to extend data type accessible. That dataset is 'situation-centric' and provides interactions' contexts. In computer sciences, and especially in the context-aware computing field, a context is, according to [32], "any information that can be used to characterize the situation of an entity". An entity is a person, place or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves, and by extension, the environment the user and applications are embedded in. Thus, considering this definition we will constitute our Contextual Dataset with:

- interaction situation contextual data: interaction localization, device and nearest point of interest;
- service interaction contextual data: front-line workers role, software used and achieved tasks;
- and optional data: living city, age group, customer contents on product, brand or touchpoints.

Those data will allow the discovery of an algorithm to classify interactions as interactions services nodes using Event Mining techniques. Hereafter, using new data type we will describe how we design the NISPARO classification technique within Service Interaction Classification component.

C. *Service Interaction and Big Data Classification*

This new component proposes to characterize a customer interaction as a service interaction status in the form of a NISPARO final node. Then, each interaction stored within customer engagement hub will receive a "current status of a service interaction". This will be possible by using new data type described in paragraph B. Final result will be interactions' categorization as "I" (or "-I"), "S" (or "-S"), "P" (or "-P"), "A" (or "-A"), "R" (or "-R").

Those categories constitute relevant aspects (Event) of the Customer Experience. According this, we do not clearly solve the question of the "N" (New event) and the "O" (Outcome) of NISPARO pattern. Conclusion section discuss about these qualitative aspects as the subject of future works.

To make categorization possible we have to use Event mining techniques. We start with a sub-dataset containing data from CEH regarding on a time interval (one day, one week, one month…). This operational dataset is our Datum for Event Mining. That will be utilized to determine interaction service status. Association Rule Mining technique combined with a neural algorithm (Naives Bayesian Network; Artificial Neural Networks in conjunction with Discriminant Analysis of Cluster) will be our first approach to determine Event (NISPARO status). Nevertheless we are fully aware that it will be insufficient. In order to be confident with our event classification, we have to add into our solution, information from previous and next event (sequential techniques). It is an important aspect because of the trajectory concept. This point will be the second one discussed in conclusion. After all, we claim that combining this robust and well-known approach with new data type will allow innovation within Customer Experience Analytics based on CJA. Next session will discuss these news insights.

D. *New insights to discover Customer Experience*

We saw in section 2 that one of the main issues of customer experience analytics within MHI is the lack of interaction contextualization. We proposed an approach to solve this using service interaction pattern NISPARO in order to classify interactions by a combination of new data type (contextual data) and Event mining techniques. Thus, following NISPARO status – events – we claim that it is possible, for each interaction, to deliver new qualitative and situated analytics, and then, new Customer Experience insights. We use [30] who links phases and situations with ISPAR failures mode and effect analysis. Resuming and extending this work we can propose six service interaction failures (type of event):

- No interaction (-I): insurer captures a relevant event but it is not convert into interaction;
- No Service Interaction (-S): customer and insurer did not succeed in starting a work collaboration (misses phone calls are example);
- No Proposal (-P): insurer has no response to the customer need;
- No Agreement (-A): there was no possibility to get mutual understanding between insurer and customer regarding service proposal;
- No Realization (-R): a problem happened to customer, insurer or both which avoid the service realization;
- No Outcome (-O): according to customer there is no particular achievement enabled thanks to interaction service realization.

Those analyses grounded on the combination of NISPARO status and failures mode and effect analysis will allow publishing quantitative analytics or a requesting capability. That is crucial to take into account qualitative aspects in Customer Experience Analytics. For example our system will be able to answer request such as "Explore customer journeys, where there are the most of failed flu vaccination service realizations, in February 2018, in Troyes, after a customer demand". Thus, we provide new type of Customer Experience Analytics based on CJA. Contribution of Big-Data techniques (Event Mining) exploiting interactions' contextual data (Datum) will help customer experience executives to fully grasp customer journey and co-design more appropriate experiences.

V. Conclusion

In this article we propose a solution dealing with Customer Experience Analytics issues based on Customer Journey Application even if, as an exploratory work, we still have to test and prove our arguments in the coming months. These issues are directly linked with existing Customer Journey Application. It focuses on interactions but do not take into account of multifaceted interaction, customer engagement and situation. We proved the need of a new theory to grasp Customer Experience: CST Theory (Context/System/Trajectory). It includes our Contextualizing Artifact solving previous issues. As a complex artifact it should be composed of multiple IT artifacts. Then, we chose to focus at first on System states component which is understood as the Context observing System (Datum). We proposed to compute it with an adapted service interaction pattern named NISPARO. We explained how we intend to build it by means of contextual dataset exploited with Event Mining techniques. Finally we revealed new analytics provided by our solution. Those aim at achieving customer journey contextual analysis and help to design relevant customer experience.

A. *Challenges*

In parallel of developing our solution to prove its effectiveness for marketing executives, we are confronted to three challenges. The first, as major constraint of this work, is time management. To be sure to classify interaction as service interaction status based on NISPARO we require a precise timestamping. Nevertheless, Datakili Proof of Concept has shown that manually recorded interactions realized by front-line workers were not done with regularity. Thus, it may introduce a bias to the results. The second require business experts to be available in order to qualify our events. Without these we will not be able to validate the

mining algorithm. Neither availability of those is guaranteed nor the acquisition of the new vocabulary introduced by NISPARO pattern. The last challenge, as we are using Design Science paradigm, concerns an organizational limit. We must prove that our new analytics are used by customer experiences executives and improves their process. Thus, we have to involve them at the beginning of the realization to make sure of their engagement.

B. Future Works

Our research has long term perspectives. The next step will consist in linking service interactions status – our events. Based on the resulting graphs we may be able to develop new visualization type allowing representing "customer living story when they experience insurance product". Our final objective will try to resolve entanglement between customer experience information system and customer engagement.

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