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Modelling data activities in workarounds: A narrative network approach

Workarounds are non-standard processes in organisations to accomplish work-based tasks. They can lead to various data issues, such as data *loss*, data *breach*, and data *privacy*. These data risks are the outcomes of the data activities that constitute a workaround (e.g. *store* data, *transfer* data). The problems with workarounds are that they are unique and situational. One way to unpack these data activities is to model them as patterns of action. Thus, this research aims to demonstrate the use of a narrative network to model data activities within workarounds and discuss both the benefits and drawbacks of using this modelling approach. We expect that this research is valuable for researchers to represent, observe, and analyse workaround-centric data activities. This action is pivotal because nobody could measure the actual costs imposed by workaround-centric data activities in an organisation. Also, we envisage that this research is useful for managers to establish organisational awareness of workarounds.

Keywords: Workarounds, Narrative Network, Data Activities, Process Modelling

1 Introduction

Research shows that workarounds are non-standard processes in organisations to complete designated working goals (Courtright, Acton, Frazier, & Lane, 1998; Koppel, Wetterneck, Telles, & Karsh, 2008; Stevenson, Israelsson, Nilsson, Petersson, & Bath, 2018). As they are non-standard, workarounds impose data risks for the organisations that employ them (Furstenau & Sandner, 2017; Khalil, Winkler, & Xiao, 2017; Silic & Back, 2014). For example, imagine a scenario where an employee stores company data on a *public cloud* to back up the current system. This scenario may be characterised as a workaround because the employee deviates from the company policy on backing up company data (Khalil et al., 2017). Here, there is no formal guarantee that the public cloud provider is trustworthy. As a result, this situation could lead to a *data breach* (Walterbusch, Fietz, Tauteberge, & Teuteberg, 2017), *data loss* (Sillic, 2019;

Walterbusch et al., 2017), or *data privacy issues* (Khalil et al., 2017). For instance, a data workaround in New York-based hospital resulted in a *data breach* with HIPPA. That is, 6,800 patients' records available on the Internet (Silic, Barlow, & Back, 2017). Thus, this data breach imposed a financial penalty of 4.8 million (Silic et al., 2017). Hence, the organisation needs to control workarounds to enhance organisational data quality (Bozan & Berger, 2018).

A workaround comprises two activity types: data activities and non-data activities. A data activity is an action that directly pertains to organisational data such as *retrieving, consuming, producing, manipulating,* and *transferring* data. Conversely, a non-data activity is an action that does NOT pertain the organisational data (Wibisono, Sammon, Heavin, & Alhassan, n.d.). In a similar vein, a non-data activity is an action that *uses no data* to enact. For example, consider a nurse that does multiple data entry activities resulting from measuring patient vital signs (Stevenson et al., 2018). In this case, the nurse *measures* a patient's vital signs, *writes* the result on a paper, and *enters* the data in the EHR at a later stage. Here, the workaround consists of one non-data activity (e.g. measuring vital signs) and two data activities *write* data and *enter* data *late*. In other words, these two data activities and one non-data activity together can be characterised as a workaround.

As data issues are natural consequences of the data activities within workarounds, we need reliable notation to model these data activities. One useful notation is a narrative network (Pentland & Feldman, 2007). A narrative network is a directed graph to represent a sequence of activities in chronological order (Pentland & Feldman, 2007). In other words, they signify the organisational patterns of action (Pentland & Feldman, 2008, p. 244). As such, a narrative network allows designers to construct multiple viewpoints regarding process materialisation (Pentland & Feldman,

2007). These multiple viewpoints frequently occur in workarounds. So, we aim *to explore the use of a narrative network to visualise data activities in workarounds.*

Next, we arrange the remaining sections as follows. Section two explains the theoretical background of our study. Section three proposes the application of a narrative network to model data activities in workarounds. Section four shows how we apply our modelling approach to selected workaround scenarios. Section five discusses the findings. Lastly, section six concludes our research and outlines opportunities for future research.

2 Theoretical Backgrounds

In this section, we explain our theoretical background in more detail.

2.1 Narrative Fragment and Narrative Network

A narrative network is a directed dyadic graph to articulate a set of interconnected functional events in their historical order (Pentland & Feldman, 2007). As a set of interconnected functional events, a narrative network represents patterns of action in an organisation and enables their visualisation (Pentland & Feldman, 2008, p. 244). Also, it can accommodate both *actual* and *possible* patterns of action (Pentland & Feldman, 2008). By having these features, an organisation can better analyse the patterns of action (Pentland & Feldman, 2007).

Furthermore, as a graph, a narrative network consists of several interconnected nodes in which each node is called a *narrative fragment,* which also represents a functional event (Pentland & Feldman, 2007). A narrative fragment comprises at least two actants (*human* or *nonhuman* actors) and one action that connect them. Here, one can see the relationship between actants and their action(s) similar to a sentence

structure: "subject – verb – object" (Pentland & Feldman, 2008). For example, "a user launches his/her web browser" or "the firewall blocks the protocols" (Pentland & Feldman, 2007). In this case, "user", "browser", "firewall", and "protocols" are the example of *actants* while "launches" and "blocks" are the examples of *actions.*

2.2 Workarounds and Data Activities

Workarounds are non-standard organisational processes to achieve designated working goals (Courtright et al., 1998; Koppel et al., 2008; Stevenson et al., 2018). Because workarounds are non-standard processes, research shows that workarounds demonstrate considerable risks for organisations (Courtright et al., 1998; Röder, Wiesche, Schermann, & Krcmar, 2015; Silic & Back, 2014). For example, they can impose organisational *data loss* (Baysari et al., 2018; Myers, Starliper, Summers, & Wood, 2017; van den Hooff & Hafkamp, 2017), *data breach* (Sillic, 2019), and *poor data quality* (Drum, Pernsteiner, & Revak, 2017; Fürstenau & Rothe, 2014; Morrison, 2015). Moreover, a workaround can emerge *at an operational level* (Eikey, Murphy, Alison, Reddy, & Xu, 2015; Furstenau & Sandner, 2017; Mallmann, Maçada, & Eckhardt, 2018), *tactical level* (Alraddadi, Champion, & Lagna, 2018), and can *propagate across organisational units* (Brooks, Ravishankar, & Ilan Oshri, 2015; Chua, Storey, & Chen, 2014; Ellingsen, Monteiro, & Røed, 2012). The actual costs that workarounds impose are difficult to measure accurately (Courtright et al., 1998).

Research shows risks that are related to data are closely related to data activities within workarounds. For example, *data loss* may happen because a user *stores* the *mandatory data elsewhere* (not in the formal system) (Zhao, Kessler, & Guo, 2019). Another example is a *data breach* may happen when a user *stores* the data *on a public cloud provider*. This provider then breaches data to a third party without the user's

consent (Walterbusch et al., 2017). Here, both activities: *store data on the cloud* and *store data elsewhere* are examples of data activities in workarounds.

The following section demonstrates how to visualise a narrative network to model data activities in workarounds. Also, we explain how to apply narrative fragments in a workaround context.

3 Modelling Data Activities in Workarounds using a Narrative Network

In this section, we propose a step-by-step approach to modelling data activities in workarounds using a narrative network.

3.1 *Proposing a narrative network for modelling data activities in workarounds*

Previous research develops narrative networks by using nodes expressed as actions (cf. Pentland, Hærem, & Hillison, 2010) or actions and actants (Goh, Gao, & Agarwal, 2011; Hayes, Lee, & Dourish, 2011; Yeow & Faraj, 2011). Given a specific context, research can develop its attributes extending from the original narrative fragment (e.g. actor and actants) (Pentland, Recker, & Wyner, 2017). For example, one can add a location or any other attributes that are relevant to the action or event (Pentland et al., 2017).

In our case, we use three attributes to characterise data activities in workarounds. That is an actor, action, and artefact—we breakdown actants into two separate concepts: actor and artefact. An actor is the one that enacts an action. Previous research indicates that an actor can be human or non-human (Dumas, La Rosa, Mendling, & Reijers, 2013; Pentland & Feldman, 2007). Here, the example of human actors are employees, users, physicians, and nurses; while non-human actors could be machines, equipment, and tools. However, in the context of data activities and

workarounds, we designate that an actor must be *human* (not a *machine*). The rationale is that the "technology appropriation" (e.g. workarounds) can only occur when the actor is human (Pentland & Feldman, 2007). Workarounds themselves would cease to exist if the organisation were capable of replacing all human actors with machines (Pentland & Feldman, 2008).

Action is the thing that an actor does to accomplish working tasks (Pentland, Feldman, Becker, & Liu, 2012). For example, *paying an invoice* (Pentland et al., 2010) or *moving a new tenant* to student housing (Feldman, 2000). In our case, an action is central because it reflects data activity. For example, *store*, *transfer*, *enter* and *analyse* data (see Table 1). These actions and data activities have direct implications for data risks. Therefore, these data-related actions need to be explicit in every narrative fragment.

An artefact is a human-made thing with specific purposes (D'Adderio, 2011). In our case, we divide the artefact into two parts: technical artefact and non-technical artefact. A technical artefact is a human-made *physical object* that possess certain functions – and created based on that function (Frederik, Sonneveld, & De Vries, 2011, p. 279). It is a tool (e.g. machine, physical paper, or computer) that an actor uses to enact the action (see Table 1). As a tool, an artefact is passive. It does not govern or determine the flow of the process (Feldman & Pentland, 2008). For example, consider an actor that uses a photocopy machine to copy documents (Dumas et al., 2013). In this sense, even though the machine (as an artefact) helps the actor to enact the action, the machine is passive. It does not determine what documents to copy or where to pass the documents after photocopying – the actor does.

A non-technical artefact is any artefact that is not a technical artefact. It has a function – but has no physical representation (Frederik et al., 2011). For example, words

in language or numbers in mathematics (Frederik et al., 2011). Here, we are concerned with one type of non-technical artefact: data. Data are a set of symbols that represent the attributes of objects and events (Ackoff, 1989). Data is an organisational asset (Khatri & Brown, 2010). Data is pivotal as it becomes the indispensable part of an action to enact. For example, storing *a patient's files* or transferring *customers' bills*. Furthermore, the organisation utilises technical artefacts to manage data (e.g. store data or transfer data) (see Table 1). For instance, a user saves a *patient's files* (data) on a *USB Stick* (technical artefact) (Gozman & Willcocks, 2015; Röder, Wiesche, & Schermann, 2014; Röder et al., 2015). Thus, a technical artefact and a non-technical artefact (e.g. data) are two distinct inter-related objects.

Table 1. Attributes that composed a node in a narrative network

No	Attribute		Note	Example
1	Actor		The human that performs the action	User, Operator
2	Action		The thing that an actor does to accomplish a working task	*Storing* data, *transferring* data, *entering* data, *analysing* data
3	Artefact	Technical Artefact	A tool that the actor uses to enact the action	Cloud storages, USB Sticks, Un-authorised apps, Physical paper
		Non-Technical Artefact (e.g. Data)	A set of symbols that represent the attributes of objects or events.	Customer data, supplier data, patient data

To conclude, by assigning the narrative fragment into three attributes: actor, action, and artefact, one can develop a comprehensive visualised mental model of workarounds. So, a researcher could avoid missing relevant data during the research process, namely interviews, document analysis, and observations. By doing so, one could better conceptualise the richness of workarounds as a phenomenon as part of the data analysis. This section shows the attributes that we develop in constructing a narrative fragment. Next, we describe how to transform the narrative from text into a narrative network.

3.2 Modelling a narrative into a narrative network

One can develop a narrative fragment from the narrative that is obtained from an interview transcript or an organisational document. The coding strategy is to extract the "subject – verb – object" structure from the narrative (Pentland & Feldman, 2008). That is, the subject indicates the actor, the verb indicates the action, and the object indicates the artefact (for our purposes, we require a technical artefact and a non-technical artefact).

4 Applying narrative networks to real workaround scenarios

This section demonstrates how to apply narrative networks in three scenarios: the *formal system use*, the *informal system use*, and the *human proxy use*. Here, each scenario represents a workaround type in organisations.

4.1 Scenario 1 –Formal system use

The first scenario is the formal system use. In this scenario, an employee uses the formal system (e.g. Enterprise Resource Planning – ERP) beyond it is official approval (cf. Baysari et al., 2018; cf. Ser, Robertson, & Sheikh, 2014; cf. van den Hooff &

Hafkamp, 2017). In modelling the formal system use, relying solely on verbs to capture data activities is sometimes not enough. One may also need to appreciate adverbs used to describe data activities. For example, consider one data activity: *entering* data. A user can enter data *inaccurately* (Lovett, Holden, Anders, Hong, & Karsh, 2013; Safadi & Faraj, 2010; Yang, Ng, Kankanhalli, & Luen Yip, 2012), *incompletely* (Beerepoot & van de Weerd, 2018; Reiz & Gewald, 2016; Stevenson et al., 2018), or *in the wrong place* (Barrett, 2018; Malaurent & Avison, 2016; Ser et al., 2014). These three data activities produce different data impacts for organisations – even though they share a similar verb: *entering* data. Hence, a modeller needs to model these data activities independently.

Table 2. The narrative of the formal system use

"Data adjustments, where users were 'cheating' the ERP system by entering data that they knew were inaccurate or that did not reflect the data codification imposed by the system but nevertheless were important for local use" (Malaurent & Avison, 2016)

Table 3. Transforming the narrative into one narrative fragment

Narrative Fragment (NF)	**Actor**	**Action**	**Artefact**	
			Technical artefact	Non- Technical artefact
NF_1	Users	Enter inaccurately	ERP System	Data



Figure 1. A narrative network from one narrative fragment – formal system use.

Table 2 shows a real scenario where formal system use is evident. We codify the scenario as a collection of narrative fragments (see Table 3) before visualising it as a narrative network (see Figure 1).

4.2 Scenario 2 –Informal system use

The second scenario presents an informal system use. In the informal system, an employee uses a system (e.g. physical paper, spreadsheet, private devices, or un-authorised application) that is beyond management approval (cf. Blijleven, Koelemeijer, & Jaspers, 2019; cf. Flanagan, Saleem, Millitello, Russ, & Doebbeling, 2013; cf. Wolf & Beverungen, 2019).

Table 4. The narrative of informal system use

"However, physicians copy patient records onto USB sticks or send it via e-mail" (Röder et al., 2014, p. 5)

Table 5. Transforming the narrative into two narrative fragments – informal system use

Narrative Fragment (NF)	**Actor**	**Action**	**Artefact**	
			Technical artefact	Non- Technical artefact
NF_1	Physicians	Copy	USB Sticks	Patient records
NF_2	Physicians	Send	Email	Patient records

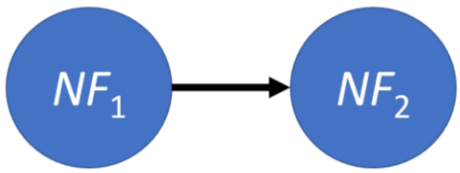


Figure 2. A narrative network from two narrative fragments – informal system use

Table 4 outlines a scenario of informal system use. Next, we codify the narrative into a narrative fragment which visualisation is available in Figure 2. The visual suggests a sequential execution of the narrative fragments but the sentences that they come from says 'OR' and not 'AND'. 'OR' means they should be at the same level in the sequence if in a narrative network (as in the user does on or the other).

4.3 Scenario 3 – The human proxy-use

The third scenario is human proxy-use. In this case, two or more simultaneous actors undertake an action. That is, one actor, can be the proxy of the other actor (cf. Barrett, 2018; cf. Eikey et al., 2015; cf. Saleem, Russ, Justice, & Hagg, 2009). For example, it is the norm in hospitals that a physician dictates notes to an administrator. During this process, an administrative or enters data on behalf of the physician (Barrett, 2018; Ser et al., 2014). Accordingly, two people are responsible for undertaking the action).

Table 6. The narrative of proxy use

"Instead of logging into the healthcare facility's electronic medical records (EMR) system to retrieve and enter patient information, a healthcare provider delegates the responsibilities to a nurse to spend more time treating patients" (Burns, Young, Courtney, Roberts, & Ellis, 2015)

Table 7. Transforming the narrative into two narrative fragments – human proxy-use

Narrative Fragment (NF)	**Actor**	**Action**	**Artefact**	
			Technical artefact	Non- Technical artefact
NF_1	Healthcare provider, Nurse	Retrieve	EMR	Patient information
NF_2	Healthcare provider, Nurse	Enter	EMR	Patient information

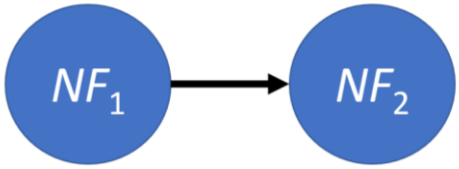


Figure 3. A narrative network from two narrative fragments – proxy use

A situation may arise where an administrator in a healthcare organisation enters the data on behalf of another staff member using another user's login (cf. Burns et al., 2015; cf. Eikey et al., 2015; cf. Ser et al., 2014). Thus, the organisation may have difficulties fully appreciating who is responsible for a data impact that may occur as a result of this action. Therefore, the modeller needs to accommodate the dynamics of each actor's roles in enacting an action in a longer time horizon.

Table 6 exhibits one scenario of human proxy-use. We codify the narrative into a narrative fragment (see Table 6). A complete visualisation of the narrative network is available in Figure 3.

5 Analysis and Discussion

There are benefits in using a narrative network approach to model data activities in workarounds. First, a narrative network could accommodate multiple viewpoints (Pentland & Feldman, 2007) in workarounds. Workarounds themselves are *unique* and *situational* (Haag, Eckhardt, & Bozoyan, 2015; Röder et al., 2014). As a result, two or more viewpoints regarding "the manifestations of workarounds and their data activities" can co-exist (D'Adderio, 2011; Feldman & Pentland, 2003). Here, the narrative network is an excellent tool to visualise and communicate diverse viewpoints.

Second, a narrative network provides a common vocabulary that is widely understood by multi-level stakeholders in the organisation (Pentland et al., 2017). In this case, one represents the narrative network as sequential relations among actions in chronological order (Pentland et al., 2017). As it is in chronological, the sequential relations tend to be easy to follow for each stakeholder. Consequently, a team could collaboratively summarise coherence and difference in intricate patterns of action (Pentland et al., 2017). Moreover, the narrative network contributes to the usage of common vocabulary in terms of organisational processes. This common vocabulary may contribute to the development of a shared mental model in the team.

This situation is prevalent in healthcare as the responsible physician more focuses on helping a critical patient in the intensive care unit. Hence, he/she often forgets to enter data in the EHR (van den Hooff & Hafkamp, 2017). There are also challenges. First, research shows that in terms of workarounds, a data activity can be characterised as “no action” (do nothing). For example, an actor (e.g. physician) is *not entering data* in the Electronic Health Record (EHR) (Blijleven et al., 2019; Reiz & Gewald, 2016; van den Hooff & Hafkamp, 2017). This situation is prevalent in healthcare as the responsible physician more focuses on helping a critical patient in the intensive care unit. Hence, he/she often forgets to enter data in the EHR (van den Hooff & Hafkamp, 2017).

As a consequence, the data is not available for the next users (Jagannath, Sarcevic, Young, & Myers, 2019). In this case, modelling such data activity is challenging because one cannot detect the action straight away. The only way to detect such activity is by assessing its impact. However, as the data impact sometimes is not immediately visible, the organisation cannot directly track the action’s existence and its actor.

Second, determining whether a data activity is a workaround may be a challenge. For example, a user can enter data on the formal system – which looks like a non-workaround action. However, they could enter the data *inaccurately* or *incompletely.* In this case, it may be challenging to determine whether the action is a workaround until the impact is evident by the downstream users (e.g. data loss or poor data quality). To avoid this situation, the modeller needs to model all data activities in the process.

6 Conclusion

Workarounds are non-standard processes in an organisation that can lead to data issues. One way to unpack workarounds and data activities that occur within them is to leverage a common language (i.e. symbols) to visualise them as models. Hence, we propose a narrative network to model data activities in workarounds. In doing so, we suggest the modeller illustrate the narrative fragment (the narrative network's building block) into three attributes. That is, actor, action, and artefact. Also, we demonstrate how to use the narrative network to model workaround-centric data activities. By modelling workarounds, we can represent, observe, and analyse workarounds as well as their data activities. Modelling workarounds are essential as the cost of workaround-centric data activities is not well understood. When one considers the reputational damage of data issues and the cost of non-value-added activities to rectify data issues, the practical value of a narrative network cannot be underestimated. Finally, we examine the benefits and challenges that a modeller can face when modelling workaround-centric data activities.

Furthermore, we acknowledge that the three scenarios presented in this article could oversimplify real-world data activities, which is our main limitation. We expect

that a real-world workaround could constitute more than two data activities. Also, it can have intricate branches and loops within. Moreover, our scenarios only show one version of a workaround and its data activities. One workaround and its data activities could have two or more versions depending on the observers' and actors' viewpoints (Pentland & Feldman, 2005).

Further research could involve applying narrative networks in a data-intensive real-world setting. In this case, one could develop "a process repository" for workarounds for specific domains (e.g. healthcare, construction, retail). This process repository stores a set of patterns of action of specific workarounds. As the repository is complete, one could compare workarounds for further elaborate analysis (finding similarities and differences). Such a repository could promote a more mindful approach to maintaining the business value of the organisations' non-technical artefacts – their data.

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