100 Years of Graphical Business Process Modelling

Guest Editorial

Ralf Laue[*,a], Heinrich C. Mayr[b], Bernhard Thalheim[c]

[a] Westsächsiche Hochschule Zwickau, Germany
[b] Alpen-Adria-Universität Klagenfurt, Klagenfurt, Austria
[c] Christian-Albrechts-Universität Kiel, Kiel, Germany

Abstract. *In December 1921, Frank B. and Lillian Moller Gilbreth held a presentation entitled "Process Charts" at the Annual Meeting of The American Society of Mechanical Engineers. They presented a diagrammatic notation for depicting work processes. This was the reason for initiating a call for papers for a special edition of the EMISA Journal. The aim of this issue is to reflect on the history of graphical business process modelling as well as on current and future challenges. In this editorial, we will shortly introduce the ideas behind the Process Charts method. We realize that some ideas discussed 100 years ago still remain highly relevant while modern work environment raises issues that would be unthinkable a century ago.*

Keywords. Business Process Modelling • Process Charts

Communicated by Ralf Laue.

1 100 Years of Process Charts

The "Roaring Twenties" – the years from 1920 until the start of the Great Depression in 1929 – are generally perceived as an era of progress and modernity. Technology such as the radio or automobiles made their entrance into the life of the middle class. Mass production became commonplace, and new management methods were needed. Scientists such as Frederick Taylor or Henry L. Gantt and engineers such as Henry Ford laid the foundations for a new way of production. In a new generation of products, standardized interchangeable parts were used, and the way to assemble and ship those products needed to be standardized too.

Frank B. and Lillian Moller Gilbreth were among the pioneers of a new field of management and organization studies which became known under the name scientific management. They used cameras to record the workers' activities and body movements. This resulted in motion studies which not only was an attempt to find the best way to do the work but also a forerunner of ergonomics. It is no surprise that a standardized notation was needed to discuss and optimize production processes. Consequently, the Gilbreths in their presentation in 1921 defined Process Charts as "a device for visualizing a process as a means of improving it"(Gilbreth and Gilbreth 1921). In modern terms, they defined the first graphical business process modeling language.

As we can see in an example process chart diagram in Fig. 1, a process chart looks similar to other common "boxes and arrows" diagrams. It depicts the flow of material and documents. Special attention is paid to different ways of moving (with special symbols e. g. for "moved by elevator" or "moved by messenger boy") and to inspections (with symbols e. g. for "Inspection for quantity by weighing"). From the perspective of today's readers who are used to work with languages such as BPMN, the presence of such specific symbols seems to be anachronistic. However, such a premature judgment only shows that the focus for

* Corresponding author.
E-mail. ralf.laue@fh-zwickau.de

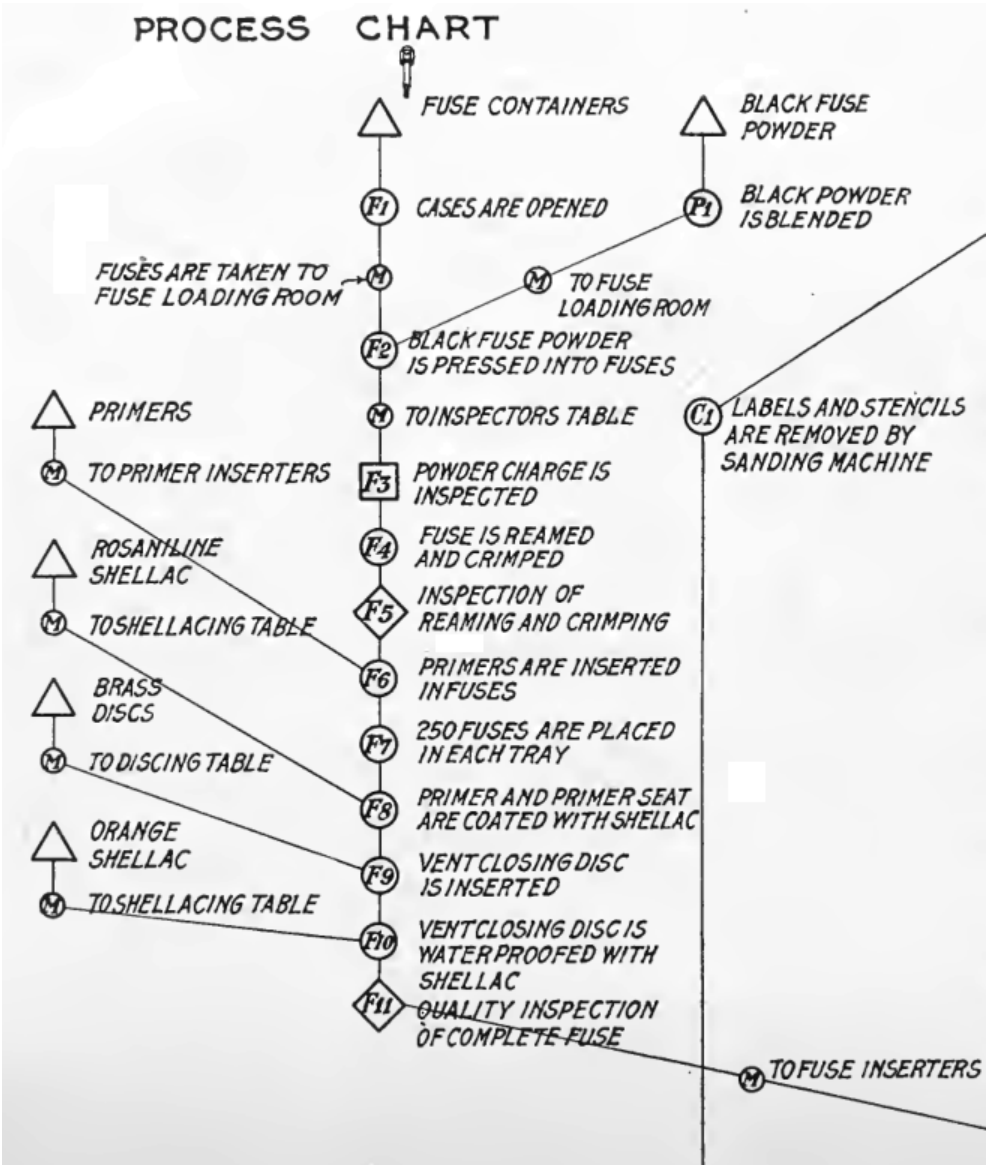

Figure 1: Visualization of a process as process chart (from Gilbreth and Gilbreth (1921))

process modelling shifted away from repetitive production processes to administrative processes. In production processes (for which languages such as BPMN are not an optimal choice (Vještica et al. 2021)), such specific symbols are not anachronistic at all: Still in 1990 the Association of German Engineers approved a standard (VDI 2860) which defines a diagrammatic language for depicting handling and assembly technology processes. Its symbols include icons for operations such as "to sort", "to position" and (as it was the case for Process Charts) "to examine weight". The same is true for the domain specific modeling languages which have been intensively worked on for some years: it is part of their nature to offer specific modeling concepts and thus also specific symbols for their representation (Karagiannis et al. 2016).

What is missing in process charts are decisions and any kind of variability. This can be explained by the fact that a key idea of F. B. and L. M. Gilbreth was to compare different ways used by different workers to complete a job (modeled as process charts) and to define the "one best way" to work as a standard to be followed by all workers. 100 years later, we would call it "reference model" and "best practice". The difference between 2021 and 1921 is that nowadays manual work that can be standardized in such a way would have to be automated whenever possible. However, it is worth to read some other statements in the 100 year old text that have lost none of their topicality. The Gilbreaths write that "the best results can come only where there is a mechanism of management that will enforce and make repetitive the conditions of the standards." (see (Gilbreth and Gilbreth 1921, p. 17)). Sounds familiar? Almost 100 years later, in one of the chapters of the "Handbook on Business Process Management, Vol. 2" (Baumöl 2015), a study is presented that reveals that insufficient commitment of management was the main failure factor of organizational change projects.

From the above statement, it can be seen that F. B. and L. M. Gilbreth did not only address the "technical" challenges of understanding and improving processes but also the social aspects of process improvement projects. They discussed the need to deal with "members of the organization who have become so accustomed to the traditional method that they cannot easily visualize a new method without prejudice" (Gilbreth and Gilbreth 1921, p. 6) as well as of the fact that "during the stress of unexpected rush in production, it is often considered advisable to continue existing practice in present processes, even though inefficient." (Gilbreth and Gilbreth 1921, p. 4). In the last section of their article, they outlined a recommended "procedure for making, examining and improving a process". (Gilbreth and Gilbreth 1921, p. 17)

Today, we observe efforts to give detailed and exact definitions of modelling languages (e. g. by means of the Business Process Definition Metamodel standard) – which is good.

On the other hand, it has to be afraid that those explanations are concentrated much more on the tools (i. e. the modelling languages) than on their usage in practice. To support this statement, one can study the research challenges in the field of Adaptive Case Management (ACM) that have been extracted by Hauder et al. (2014) from published articles on the subject by means of a database-driven literature review. While technical aspects of ACM tools such as "data locking" or "shared memory" were among the identified research challenges, challenges discussing the organization of ACM projects, coping with common risks and obstacles due to human behaviour or factors behind success and failures of ACM projects are missing.

From the success of Gilbreths' method we can learn that in addition to define the syntax and semantics of a modelling language, it is very helpful to deal with its *pragmatics*, i. e. to reason about usage scenarios.

Another interesting observation can be made in the standard document "Operation and Flow Process Charts" which was published by the American Society of Mechanical Engineers when they approved the process charts notation as a standard in 1947. It explicitly addresses recommendations for layout ("Usually, a chart of the most pleasing appearance will be obtained by choosing the component on which the greatest number of operation

is performed") as well as for linguistic style ("inspections may be described in the passive voice"). In addition, the choice of appropriate symbols is explicitly discussed (e. g. "should be capable of being drawn free hand easily, poor draftsmanship should not result in confusion with another symbol").

All this would be unusual in current standard documents. This raises the need to address such points in research (e. g. Leopold et al. (2013), Moody et al. (2010), and Purchase et al. (2002)) with the disadvantage that those research papers unfortunately do not have the impact that the standard document could have.

2 Articles in This Issue

This special issue received seven submissions; three articles have been accepted for publication. All submissions have undergone a blind review, and we would like to thank the reviewers for their comprehensive comments.

Jan Mendling provided an article that perfectly fits the historic focus of this special issue. His paper deals with the PhD thesis of Fritz Nordsieck (1931) which builds on 105 references and discusses a rich variety of diagrams that have been suggested in the 1920's and 30's to depict the flow of work.[1]

The second paper, submitted by Daniel Amyot, Okhaide Akhigbe, Malak Baslyman, Sepideh Ghanavati, Mahdi Ghasemi, Jameleddine Hassine, Lysanne Lessard, Gunter Mussbacher, Kai Shen, and Eric Yu, provides some historical background too – even if it covers "only" two decades. The article reports on experiences with the User Requirements Notation, a standard which aims not only to model *what* is done in a process but also *why* and *for whom* it is done.

Another approach – subject-oriented modelling – is addressed by the third article in this special issue. Christoph Moser, Matthes Elstermann, and Udo Kannengiesser discuss the use of the Parallel Activity Specification Schema (PASS) notation in the field of digital manufacturing. This is where the content of this issue comes full circle – good diagramming techniques have the same importance today for the digital revolution than they had 100 years ago in the shift to standardized mass production.

[1] By the way: The first known reference to the term "work flow" can be found in a text from 1921 too – in a presentation called "Behind the Scenes in a Railway Locomotive Workshop" held by J. W. Smith at the Manchester Congress of the Institute of Transport in 1921. (Smith 1921)

References

Baumöl U. (2015) Cultural Change in Process Management. In: Handbook on Business Process Management 2. Springer, pp. 665–692

Gilbreth F. B., Gilbreth L. M. (1921) Process Charts. In: The American Society of Mechanical Engineers, presented at the Annual Meeting, December 5 to 9, 1921

Hauder M., Pigat S., Matthes F. (2014) Research Challenges in Adaptive Case Management: A Literature Review. In: 2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations, pp. 98–107

Karagiannis D., Mayr H. C., Mylopoulos J. (2016) Domain-Specific Conceptual Modeling. Springer

Leopold H., Eid-Sabbagh R., Mendling J., Azevedo L. G., Baião F. A. (2013) Detection of naming convention violations in process models for different languages. In: Decision Support Systems 56, pp. 310–325

Moody D. L., Heymans P., Matulevicius R. (2010) Visual syntax does matter: improving the cognitive effectiveness of the *i** visual notation. In: Requirements Engineering 15(2), pp. 141–175

Purchase H. C., Allder J., Carrington D. A. (2002) Graph Layout Aesthetics in UML Diagrams: User Preferences. In: Journal of Graph Algorithms and Applications 6(3), pp. 255–279

Smith J. W. (1921) Abstract of a paper entitled "Behind the Scenes in a Railway Locomotive Workshop", read at the Manchester Congress of the Institute of Transport. In: The Railway Engineer 42, p. 108

Vještica M., Dimitrieski V., Pisarić M., Kordić S., Ristić S., Luković I. (2021) Towards a Formal Specification of Production Processes Suitable for Automatic Execution. In: Open Computer Science 11(1), pp. 161–179