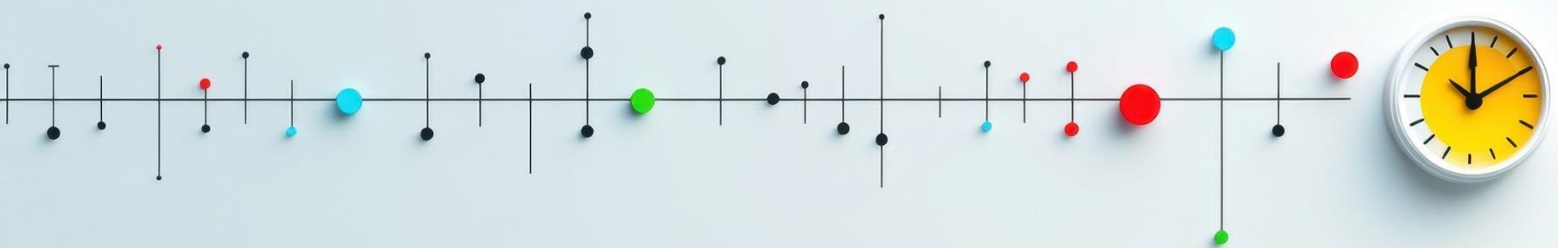


TIMELINES AS TOOLS FOR DATA VISUALIZATION AND COMMUNICATION IN SCIENTIFIC CONTEXTS – A PRACTICAL GUIDE

Version 1.0

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1. Introduction

Why should you use a timeline for data visualization?

Timelines are useful tools for visualizing events in chronological order. They are ideal for telling stories and presenting data that changes over time. [1] They are a type of data or information visualization (or graphic) that depicts abstract data in a computer-based, interactive and visual way for easier cognitive processing [2]:

"The timeline is a spatial representation of the abstract historical progression of time. Years are plotted on a (usually) horizontal straight line. Larger historical periods can be marked, events localized, and historical situations, structures, and processes depicted and explained with the help of texts, images, or maps. The degree of complexity can vary greatly. "¹ [3, p. 211]

Application examples for timelines are:

- Project progress
- Institutional history
- Development of competencies in a research group/institution
- Development of a technology, method, concept, etc.
- And much more

What does this guide contain?

The guide contains detailed descriptions of the necessary steps and tips for practical application. Detailed suggestions for the metadata schema make it easier for you to fill the timeline with content. At the end of the document, there are two practical examples based on this content.

Who is this guide suitable for?

This guide is aimed at library staff, communications managers, and researchers who want to use timelines as a communication or documentation tool, as well as anyone who works with (scientific) data and wants to present it in a structured, understandable, and visually appealing way.

How can this guide help you?

This guide provides step-by-step instructions and practical tips on how to create a well-designed timeline. Since creating timelines is a highly individual activity and depends heavily on the topic, the communication objective and the tool used, all content in this guide should be considered non-exhaustive and illustrative. It provides ideas and building blocks that you can use individually for your specific application.

The guide is the result of a practical project from the [certificate course Research Data Management](#) - a cooperation between [fdm.nrw](#), [ZB MED](#), and [ZBIW](#). It contains research results and lessons learned from the practical implementation of the concept, presented in a guide structure.

2. Creating good conditions: helpful skills and resources

Various skills and resources are helpful in creating good conditions for your project. This list will help you to assess whether your foundation is sufficient.

- Time and financial budget: When creating a timeline, most of the time is spent on planning. How much time is needed depends, among other things, on the other requirements: If the information first has to be researched, you should allow for more time. The tool may also incur costs that you should calculate in advance.
- A competent project team: The most important skill is (meta) data literacy. Depending on the content of the data to be displayed on the timeline, it may be helpful to involve other staff members, such as research assistants with expertise in their research topics or non-scientific staff from the library or administration.
- Computational thinking and programming skills: For code-based customizations, at least Vibe Coding [4] (artificial intelligence-supported code generation) is helpful. For simple code generation,

¹ Translated from German by the author.

such as HTML-code, this approach is usually sufficient. If Vibe Coding reaches its limits, you should involve people who are proficient in the relevant programming language in the project.

- Communication affinity and a good connection with the communication department: The more a story is at the forefront of the timeline, the more helpful knowledge in the area of external communication is, as texts have to be written and the timeline has to be integrated into the message of a website, for example.
- Good institutional knowledge and a large network: Depending on the knowledge management structures, compiling data can depend heavily on the knowledge of individual persons. Therefore, your own knowledge and a large network are helpful in research.

3. Overview of the work steps

The creation of a timeline comprises two phases (see Figure 1). Each phase consists of several steps whose contents are closely related. It is therefore advisable to coordinate the steps.

- Phase 1 - Preliminary work: At the beginning, it is important to select the [type of timeline](#) and [tool](#) as well as initial ideas on the [communication](#) and [metadata concept](#). At the end of this phase, you will have created a framework for the data you want to communicate.
- Phase 2 - Implementation: Next, you then develop the [communication](#) and [metadata concept](#) further by selecting data and information ([elements in the timeline](#)) and entering them into the tool. These three aspects must continue to be harmonized with each other. It may happen that the concept sketches reach their limits during practical implementation. It is then necessary to find the lowest common denominator in order to make the concepts functional for the continuation of the timeline.

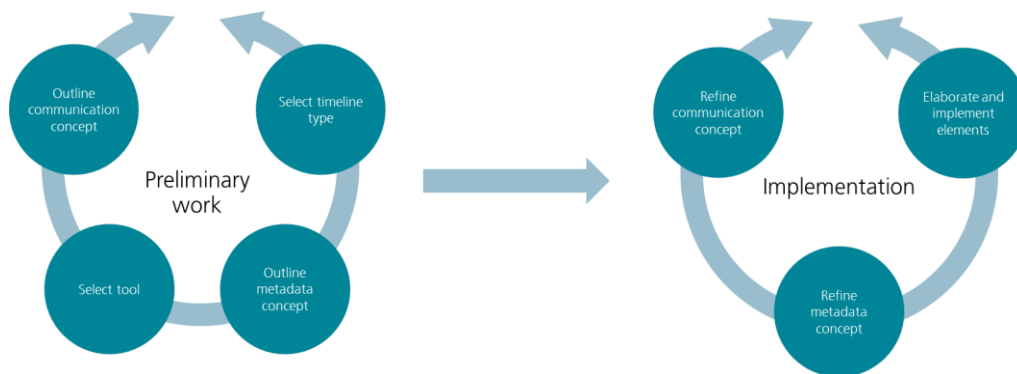


Figure 1: Steps involved in creating a timeline

How much time you need to create a timeline depends largely on the requirements. In general, the more elements, the more time-consuming it is. The following chapters describe in more detail what needs to be done in each step.

4. Type of timeline

There are basically two types of timelines: sequential and scaled (see Figure 2). Sequential timelines only show the chronological sequence of elements. The distances between the elements are uniform. Scaled timelines, on the other hand, depict the actual dates and time periods of the elements. They present the information more realistically and give viewers a precise idea of the timing of events. [5] The decision as to which type to use should be based on your [communication concept](#). In some cases, the [tool](#) may also impose restrictions on the presentation.

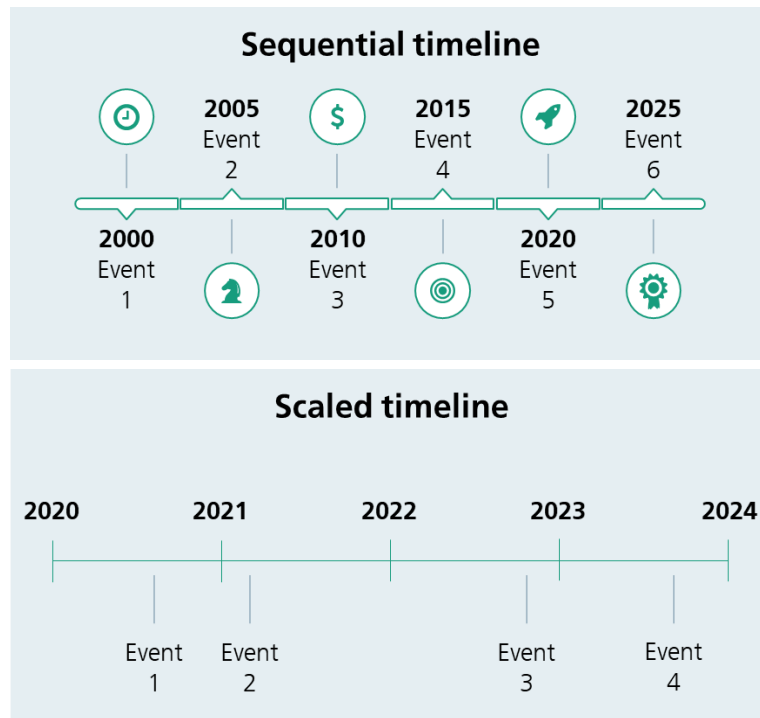


Figure 2: Basic types of timelines [1]

Both types can be presented interactively using web and multimedia technologies, making them active and usable in dialogue and supporting the processing of information, with the degree of freedom of interaction varying between the individual media [6]. The lowest form of interactivity is the inclusion of a link. Higher degrees include filter functions or the ability to move elements or to call up further information by clicking on them. [7]

The guide mainly refers to interactive timelines.

5. Communication concept

The communication concept consists of three components: the [communication objective](#), the [dramaturgy pattern](#), and the [story](#). An essential part of the [communication objective](#) is the message, as it forms the basis for subsequent steps (see Figure 3). The [dramaturgy pattern](#) determines how users should discover the message: individually or guided. This guidance is supported by the [story](#). The more linear users are supposed to consume the timeline, the more necessary a [story](#) for guidance. If the timeline is non-linear, so that users discover it individually, no [story](#) is necessary.

In this chapter you will find descriptions and practical tips on the three components of the communication concept.

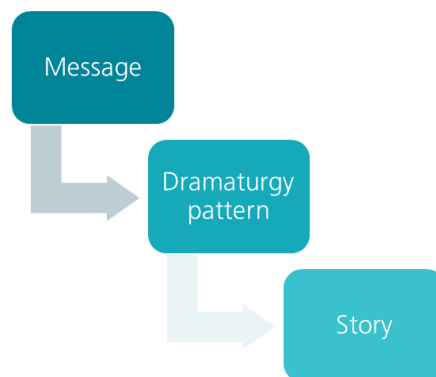


Figure 3: Relationship between message, dramaturgy pattern and story

5.1 Communication objective

The communication objective answers the central question: "What should the timeline achieve?" When formulating the communication objective, these questions are helpful [8]:

- Who is sending the message? The more you know about the person or institution sending the message, the more authentic and targeted you can make your communication. Identity, values, previous communication strategies, and the image of the sender all play a role here.
- Who should the message reach? The target group is at the center of communication. The communication content should be tailored to the characteristics of a clearly defined target group—their interests, lifestyles, and expectations—so that it is relevant to them and they can connect with the message.
- What is the message? This is where the first two questions get involved. The message is the core message and, ideally, consists of a single sentence. It conveys what the sender really wants to say. Formulate it clearly and tailor it to the target group.

5.2 Dramaturgy patterns

The dramaturgy pattern determines whether users should follow a common thread when interacting with the timeline. There are three predominant patterns in interactive infographics, each of which is related to timelines in the following [9]:

Linear dramaturgy

The senders define a step-by-step dramaturgy, for example using navigation tools such as forward and back buttons (see Figure 4). This ensures that the visualization communicates the message as intended. However, users often lack an overall view of the information.

Timelines with this dramaturgy only allow jumping from one element to another. They are suitable for purposes where the story is in the foreground and must be communicated as intended.

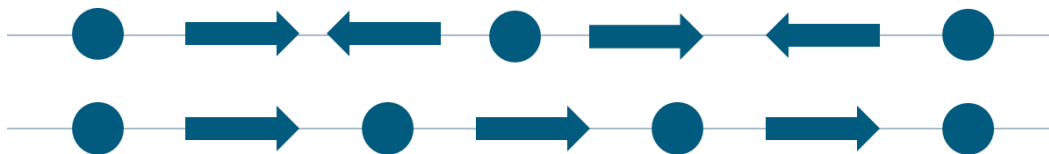


Figure 4: Linear dramaturgy

(Lines = predefined click paths; circles = elements; arrows = navigation direction) [7]

Non-linear dramaturgy

Users go through an individual process of discovery and insight, which may be supported by a moderation text (see Figure 5). In this way, data visualization can answer several questions at once, supported by navigation tools such as filters or input boxes. However, this does not guarantee that users perceive the intended message.

Timelines with this dramaturgy do not follow a coherent story, so users must discover individual connections themselves. For example, a moderation text may place a collection of publications in the context of the overarching topic - but it is up to the users themselves to discover connections such as recurring authors or publications that build on each other.

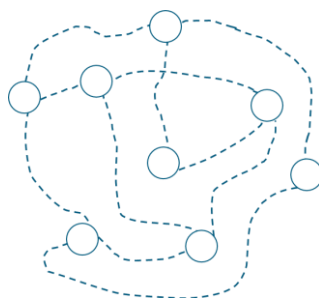


Figure 5: Non-linear dramaturgy

(Lines = possible click paths; circles = elements) [7]

Linear-nonlinear dramaturgy

The hybrid of linear and nonlinear dramaturgy patterns combines the structured communication of a message with opportunities for individual discovery by the user. There are three predominant pattern variations:

- Linear start, nonlinear end: The entry point is predetermined by navigation, after which users can explore the visualization themselves. A nonlinear timeline can be preceded by a text that must be read before the timeline can be accessed.
- Nonlinear entry, linear continuation: There are various entry points, followed by linear navigation. The individual elements of timelines can each contain further information displayed linearly.
- Linear guidance through a nonlinear structure: Both dramaturgy patterns are offered simultaneously, allowing users to explore the information themselves or be guided through the story. Timelines whose elements are visible at a glance allow for both linear guidance and individual discovery.

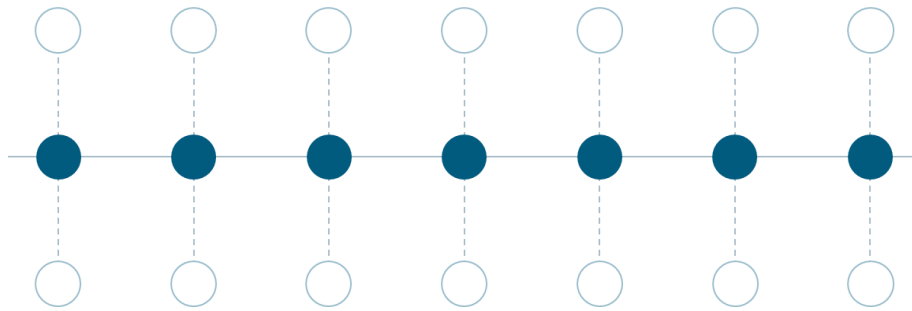


Figure 6: Linear-nonlinear dramaturgy
(Solid line = predefined click path; dashed lines = possible click paths; circles = elements) [7]

5.3 Story

For the purposes of this guide, the story is a coherent narrative along a timeline: with a defined beginning and end and several stations in between. Do not confuse it with the message. This message is only conveyed through the story and the dramaturgy pattern.

Tailor the story specifically to the message and the chosen dramaturgy pattern. It focuses exclusively on content that is relevant to the core message. At first glance, events such as the founding of an institution or the first appearance of a technology are suitable as a starting point - but should only be selected if they provide real added value for the message. Otherwise, it makes sense to start the story later.

Larger stories can be divided into several narrative strands using categories and filters. However, it is important not to fall into the trap of system constraints, otherwise you risk losing the common thread.

6. Timeline tool

Create a [list of requirements](#) for selecting the tool. In this list, you collect the requirements that arise from the type of timeline, the communication objective, the metadata concept, and also the IT regulations of your institution. These criteria will make it easier for you to choose the right tool. The [collection of tools](#) in this guide provides an initial starting point.

6.1 Requirements

This checklist will help you create the requirements list. Add your own questions as needed.

- What type of data should the timeline display? See also "[Forms of appearance](#)".
- In which environment should the timeline be integrated? Possible options include presentations, printed materials, websites, etc. This results in requirements such as a specific file format for the print or embedding options on the website.
- Which target group should have access to the timeline? If the use case is internal communication, it will only be your own employees, or also external parties if the timeline is used as a marketing tool.

- Should the timeline be interactive? When clicking on an element, additional information can be displayed, links to further content can be provided, or visual adjustments such as zooming can be made.
- What are the visual requirements for the timeline? Pay attention to your institution's corporate design (colors, fonts, etc.) or special alphabets such as Cyrillic.
- How should the data be entered? Is a graphical user interface necessary, or do the people implementing the timeline have programming skills?
- What are the requirements of your institution's IT department and information security? Consider, for example, information security concepts, the handling of licenses and contracts, and procurement processes.
- Should readers be guided through the elements in a specific order, or should they be able to discover them independently? The choice of [dramaturgy pattern](#) is based on this.
- What is the communication objective? The target group and the message are particularly important. See also "[Communication objective](#)".
- What resources are available? This point refers to resources such as financial budget, data-competent staff, subject-competent staff (related to the content of the timeline), and available working time. See also "[Creating good conditions: helpful skills and resources](#)".

6.2 Tool collection

This collection of tools that can display timelines is not exhaustive but shows the spectrum that spans between more or less interactive tools.

6.2.1 Tools for low- to non-interactive timelines

If you are planning a mere presentation that does not require interactivity, presentation tools such as [MS PowerPoint](#) or [Open Office](#) and online whiteboards such as [Miro](#) or [Conceptboard](#) are suitable. WordPress plugins such as [Cool Timeline](#) or [Getwid](#) also enable implementation on websites.

Minimal interactive functions such as embedding links to further information or directly playable videos are possible. The timelines in these tools often have a size limit and are rigid, meaning that not an unlimited number of elements can be displayed, or the timelines cannot display many elements without becoming confusing.

6.2.2 Tools for interactive timelines

Tools that can create interactive timelines include [Genially](#) and [TimelineJS](#). Like the latter, [Histropedia](#) also has the option of creating the data basis via a Google Sheet. In addition, a JavaScript library and a data query from the Wikidata knowledge graph can also be used for this purpose.

The degree and possibilities of interactivity vary from tool to tool. The timelines can be designed more freely in these tools and a larger number of elements can be displayed.

7. Elements in the timeline

An element (the data to be displayed) is an event. It can take various [forms](#). Depending on the communication objective, the focus is on the content or the formal [information level](#). Think carefully about the elements so that they convey clear messages and are not overloaded with additional information.

7.1 Information levels

Elements in a timeline have two levels of information: a formal level and a content level (based on formal and subject indexing in librarianship [10]). The formal information level contains the [appearance](#) and its corresponding properties, which it naturally possess even without being integrated into a timeline. The content information level contains the topic or content, a statement tailored to the communication objective and a context created by the timeline.

The [metadata](#) of the elements is derived from the information levels. For example, the context can be created by assigning categories that serve as filters. Depending on [their appearance](#), the elements also have different [formal metadata](#).

The greater the similarity between the elements, the more important the formal information level becomes. In this case, the [metadata](#) serves to structure and compare. If the elements are very different, their relationship with each other is often not obvious at first glance. Here, the [story](#) and thus the content level come to the fore.

Two examples clarify the distinction between the information levels:

- Timeline of publications on a technology: The aim is to communicate that an institution has more than 30 years of research experience with this technology. Formally, the events have the appearance of publications. They hold metadata such as the authors, publication date, title, etc., and provide information on when and where the research was communicated. In terms of content, each publication conveys a statement such as "We published our first publication on this technology 30 years ago" or "This publication discusses our groundbreaking discovery that fundamentally changed the view of this technology". These statements are evident from metadata such as the abstract. Together, they form the message of the communication objective.
- Timeline for the development of new software: The aim is to communicate the potential benefits of using the software for companies. Formally, the events take various forms, such as a machine on which the software was successfully implemented or a consortium that was formed for further development. The formal metadata for these elements is not unimportant, because it informs the users of the timeline about its nature. However, the formal information level is in the foreground here, as the elements must be linked to form a story. The story begins with the idea for the software and ends in the present. In between there are milestones that advance development and show step by step how companies could benefit from the software - the message of the timeline.

7.2 Forms of appearance

The elements in timelines can appear in various forms. Especially when you provide additional information for an element, make sure you are clear about what the focus is so that you can specify the appropriate metadata. The following list of forms (see Figure 7) is not exhaustive and not always clear-cut.

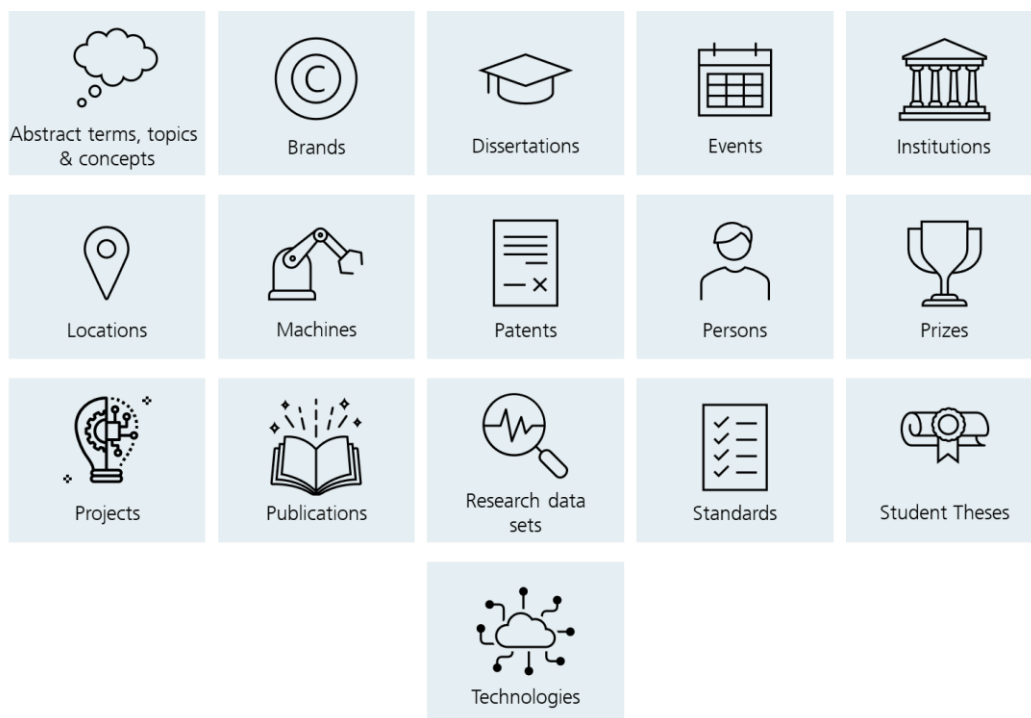


Figure 7: Forms of appearance of timeline elements

8. Metadata concept

The tables in this chapter show possible metadata that you can use to enrich the elements. The selection must be made individually according to [the type of timeline](#), [tool](#), and [communication concept](#). The tables should therefore be understood as suggestions.

The following information is provided for each metadata item:

- Sequential number
- Name of the metadata
- Type of metadata:
 - String: short alphanumeric character string, can be several words
 - Text: unlike a string, this is a coherent text
 - Date/time: single date or period, possibly also time
 - Object: embedded images, files, etc.
 - URL: functional link to further resources
 - Number: absolute number
 - ID: identification number
 - Coordinates: geographical position of a location
- Definition: contains description of metadata, format, examples, and tips
- Frequency: 0, 1, and n (as often as desired) are possible
- Obligation: Essential metadata is mandatory for a timeline; all other metadata is mandatory/optional.

The field in which you enter the respective metadata is not specified in the tables, as this depends on the tool. Add it when adapting the metadata schema for your use case.

8.1 Global metadata

Global metadata is element-independent or refers to the timeline itself.

Table 1: Global metadata

Number	Name	Type	Definition	Frequency	Obligation
0.1	Timeline	String	Concise title describing the timeline Appearance: observe institutional writing rules if necessary	1	Mandatory
0.2	Filter	String	Concise title describing the filter Appearance: observe institutional writing rules if necessary	0-1	Mandatory/optional

0.2.1	Category_Filter	String	Short, concise title that describes the category Appearance: observe institutional writing rules if necessary	0-1	Mandatory if filters are used
0.2.1.2	Color_Category_Filter	String	Color of the category for visual differentiation in the timeline Appearance: depends on the tool, e.g. hex or RGB code	0-1	Mandatory/optional

8.2 Metadata for the content information level

Table 2: Metadata for the content information level

Number	Name	Type	Definition	Frequency	Obligation
1.1	Title_Element	String	Title describing the respective element Short, concise, observe institutional writing rules if necessary The number of characters may be limited	1	Mandatory
1.2	Subtitle	String	Supplementary title Appearance: observe institutional writing rules if applicable	0-1	Mandatory/optional
1.3	Description_Element	Text	Description of the element in terms of the story Should include a description of the time or space to contextualize it Appearance: observe institutional writing rules if necessary	1	Mandatory
1.4	Point in time	Date/time	Time or period in the timeline Depends on the tool	1	Mandatory
1.5	Cover image	Object	Image that visually represents the element URL or embedded object In timelines with many elements, those without an image quickly get lost. In this case, it makes sense to either use an image for each element or for none.	0-1	Mandatory/optional
1.6	Description_Cover image	String/text	Description or alternative text to the cover image, short Appearance: observe institutional writing rules if necessary	0-1	Mandatory/optional
1.7	Additional image	URL/object	Additional images URL or embedded object	0-n	Mandatory/optional
1.8	Title_Additional image	String	Title describing the respective element Short, concise, observe institutional writing rules if necessary The number of characters may be limited	1	Mandatory if additional image is available

1.9	Description_Additional image	String/text	Description or alternative text for the additional image, short	0-n	Mandatory/optional
1.10	Additional information	URL/object	(References to) Further content URL, embedded media Full texts of publications, YouTube videos, podcast episodes, information websites	0-n	Mandatory/optional
1.11	Title_Additional information	String	Descriptive title for additional information, consisting of one word if possible Derived from the content of metadata 1.3 "Description", can be general (e.g., "dissertation") or specific, for example, the name of a tool discussed in the description Can also be a global metadata if all additional information has the same title	1	Mandatory if additional information is available
1.12	Description_Additional information	Text	Description	1	Mandatory if additional information is available
1.13	Weight	Number	Relevance of the element in the timeline	0-1	Mandatory/optional

8.3 Metadata for the formal information level

The metadata for the formal information level corresponds to the respective [form of appearance](#).

8.3.1 Abstract terms, topics & concepts

For example, "Industry 4.0" or "lifelong learning".

Table 3: Metadata for the appearance form "Abstract terms, topics & concepts"

Number	Name	Type	Definition	Frequency	Obligation
2.1	Name_Term	String	Name of the abstract subject term Should be known to the target group, can therefore also come from the respective technical language Short, concise	1	Mandatory
2.2	Definition	Text	Definition of the facts to illustrate the understanding of them in the timeline Appearance: observe institutional writing rules if necessary	0-1	Mandatory/optional

2.3	Discipline	String	Disciplines for which this subject matter is relevant in order to provide context for the term Individual controlled vocabulary, e.g., according to DFG classification	0-n	Mandatory/optional
2.4	History	Text	Description of how the discourse, definition, etc. of this issue has developed over time Should be tailored to the target audience in terms of language E.g., first appearance, further developments, etc. Appearance: observe institutional writing rules if necessary	0-1	Mandatory/optional
2.5	Source	String	Sources from which the information described in this element originates	0-n	Mandatory/optional

8.3.2 Brands

Table 4: Metadata for the appearance form "Brands"

Number	Name	Type	Definition	Frequency	Obligation
3.1	Name_Brand	String	Brand name Ensure correct spelling	1	Mandatory
3.2	Logo	Object	Brand logo	1-n	Mandatory
3.3	Date of application	Date	Date on which the brand was applied for at the competent authority (in Germany, this is the German Patent and Trade Mark Office) Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
3.4	Applicant	String	Name of the person who registered the brand Format: First name Last name	0-n	Mandatory/optional
3.5	Slogan	String	Brand slogan Use official spelling	0-n	Mandatory/optional

8.3.3 Dissertations

Table 5: Metadata for the appearance form "Dissertations"

Number	Name	Type	Definition	Frequency	Obligation
4.1	Title_Document	String	Full title of the dissertation as it appears on the document	1	Mandatory
4.2	Author	String	Name of the author Format: First name Last name	1	Mandatory
4.3	Reviewer	String	Name of the reviewer Format: First name Last name	0-2	Mandatory/optional
4.4	University	String	Name of the university awarding the doctoral degree Use the official name of the university, no abbreviations	0-1	Mandatory/optional
4.5	Identifier	ID	Identifier of the dissertation E.g., ISBN or DOI Format depends on the type of identifier	0-n	Mandatory/optional

8.3.4 Events

Table 6: Metadata for the appearance form "Events"

Number	Name	Type	Definition	Frequency	Obligation
5.1	Title_Event	String	Title of the event	1	Mandatory
5.2	Event date	Date	Date of the event Format depends on tool, observe institutional writing rules if necessary Corresponds to the date defined in the content information level for the timeline	1	Mandatory
5.3	Organizer	String	Organizing persons or institutions Format Person: First name Last name Institution: Use the official name of the institution, no abbreviations	0-n	Mandatory/optional
5.4	Location	String	Location of the event	0-n	Mandatory/optional

5.5	Type	String	Type of event Use individual controlled vocabulary	0-n	Mandatory
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8.3.5 Institutions

For example, universities, companies, or associations.

Table 7: Metadata for the appearance form "Institutions"

Number	Name	Type	Definition	Frequency	Obligation
6.1	Name_Institution	String	Name of the institution Use the official name of the institution, no abbreviations	1	Mandatory
6.2	Location	String	Location of the institution There may be multiple locations	0-n	Mandatory/optional
6.3	Date of foundation	Date	Date on which the institution was founded May vary for different locations Format depends on tool and writing rules	0-n	Mandatory/optional
6.4	Number of employees	Number	Absolute number of employees at the institution, no full-time equivalents or similar May vary for different locations	0-n	Mandatory/optional
6.5	Research focus	String	Research areas in which the institution focuses its activities Use individual controlled vocabulary Should be tailored to the target audience in terms of language and, if necessary, follow institutional writing rules if necessary	0-n	Mandatory/optional

8.3.6 Locations

For example, cities, or university campuses.

Table 8: Metadata for the appearance form "Locations"

Number	Name	Type	Definition	Frequency	Obligation
7.1	Name_Location	String	Name of the location	1	Mandatory

7.2	Coordinates	Coordinates	Geographical coordinates of the location, or the center point for larger areas	0-1	Mandatory/optional
7.3	Country	String	Country in which the location is located	0-1	Mandatory/optional
7.4	History	Text	History of the location that is relevant to the communication objective Should be tailored to the target audience in terms of language, and follow institutional writing rules if necessary	0-1	Mandatory/optional
7.5	Institution	String/text	Institutions located at this location Use the official name of the institution, no abbreviations If string, several institutions can also be specified	0-n	Mandatory/optional

8.3.7 Machines

Table 9: Metadata for the appearance form "Machines"

Number	Name	Type	Definition	Frequency	Obligation
8.1	Name_Machine	String	Name of the machine according to the manufacturer	1	Mandatory
8.2	Functionality	String/text	Description of what the machine does If string, use individual controlled vocabulary if necessary If string, multiple functionalities can also be specified	1-n	Mandatory
8.3	Acquisition date	Date	Date on which the machine was delivered to the respective institution Format depends on tool, observe institutional writing rules if necessary	1	Mandatory/optional
8.4	Manufacturer	String	Manufacturer of the machine Use the official name of the manufacturer, no abbreviations	1-n	Mandatory/optional
8.5	Model designation	ID/string	Model designation of the machine according to the manufacturer Type depends on the form of the model designation	1	Mandatory/optional

8.3.8 Patents

Table 10: Metadata for the appearance form "Patents"

Number	Name	Type	Definition	Frequency	Obligation
9.1	Title_Document	String	Title of the patent as it appears on the document	1	Mandatory
9.2	Patent number	ID	Patent number	1	Mandatory
9.3	Publication date	Date	Publication date of the patent Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
9.4	Application date	Date	Date of application for the patent Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
9.5	Inventor	String	Name of the inventor Format: First name Last name	0-n	Mandatory/optional

8.3.9 Persons

For example, institute directors or politicians. Please note the protection of personal data!

Table 11: Metadata for the appearance form "Persons"

Number	Name	Type	Definition	Frequency	Obligation
10.1	Name_Person	String	Name of the person Format: First name Last name	1	Mandatory
10.2	Affiliation	String	Institutional affiliation of the person Use the official name of the institution, no abbreviations	0-1	Mandatory/optional
10.3	ORCID	ID	ORCID of the person Format with or without link resolver: https://orcid.org/0000-0001-2345-6789 or 0000-0001-2345-6789	0-1	Mandatory/optional
10.4	Occupation	String/text	Occupations performed by the person Use individual controlled vocabulary if strings are used If string, multiple activities can also be specified	0-n	Mandatory/optional

10.5	Focus topic	String/text	Topics in which the person primarily active Use individual controlled vocabulary if strings are used If string, multiple focus topics can also be specified	0-n	Mandatory/optional
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8.3.10 Prizes

Table 12: Metadata for the appearance form "Prizes"

Number	Name	Type	Definition	Frequency	Obligation
11.1	Title_Prize	String	Name of the prize	1	Mandatory
11.2	Distributor	String	Persons or institutions awarding the prize Format Person: First name Last name Institution: Use the official name of the institution, no abbreviations	0-n	Mandatory/optional
11.3	Award date	Date	Date of the award ceremony Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
11.4	Awardee	String	Name of the award winners Format: First name Last name	1-n	Mandatory
11.5	Subject	String/text	Content that is labelled Use vocabulary if strings are used If string, multiple subjects can also be specified Should be tailored to the target audience in terms of language, and follow institutional writing rules if necessary	1-n	Mandatory

8.3.11 Projects

Table 13: Metadata for the appearance form "Projects"

Number	Name	Type	Definition	Frequency	Obligation
12.1	Project manager	String	Name of the persons in charge Format: First name Last name	1	Mandatory/optional
12.2	Title_Project	String	Official project title	1	Mandatory

12.3	Funding organization	String	Institution providing the project funds	1-n	Mandatory/optional
12.4	Project duration	Date	Period during which the project is being processed Format depends on tool, observe institutional writing rules if necessary	1	Mandatory/optional
12.5	Project partner	String	Other institutions involved in the project	0-1	Mandatory/optional

8.3.12 Publications

Table 14: Metadata for the appearance form "Publications"

Number	Name	Type	Definition	Frequency	Obligation
13.1	Author	String	Name of the author Format: First name Last name	1-n	Mandatory
13.2	Publication date	Date	Publication date Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
13.3	Title_Document	String	Title of the publication as it appears on the document	1	Mandatory
13.4	Type	String	Type of publication (article, book, conference paper, etc.) Use individual controlled vocabulary	1	Mandatory
13.5	Publisher	String	Publisher that published the publication	0-1	Mandatory/optional

8.3.13 Research data sets

Table 15: Metadata for the appearance form "Research data sets"

Number	Name	Type	Definition	Frequency	Obligation
14.1	Title_Research data set	String	Title of the research data set, e.g., as specified in the repository It is best to upload research data sets to repositories and link them in the timeline to ensure FAIRness	1	Mandatory
14.2	Creator	String	Name of the creator Format: First name Last name	0-n	Mandatory/optional
14.3	License	String	License under which the research data set may be reused	0-1	Mandatory/optional

			Ensure that the full license name is specified, e.g., including version number Information on the most common license set (Creative Commons) can be found here .		
14.4	Keyword	String	Keyword describing the content of the research data set Use individual controlled vocabulary Should be tailored to the target audience in terms of language	0-n	Mandatory/optional
14.5	Abstract	Text	Short text describing the content of the research dataset Should be tailored to the target audience in terms of language and, if necessary, follow institutional writing rules when rewritten for the timeline	0-1	Mandatory/optional

8.3.14 Standards

Table 16: Metadata for the appearance form "Standards"

Number	Name	Type	Definition	Frequency	Obligation
15.1	Title_Document	String	Title of the standard as it appears on the document	1	Mandatory
15.2	Standard number	ID/string	Number of the standard	1	Mandatory
15.3	Publication date	Date	Publication date of the standard Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
15.4	Application area	String	Industries, technologies, etc. in which this standard can be applied Use individual controlled vocabulary Should be tailored to the target audience in terms of language	0-n	Mandatory/optional
15.5	ICS classification	ID	ICS classification of the standard	0-n	Mandatory/optional

8.3.15 Student theses

Table 17: Metadata for the appearance form "Student theses"

Number	Name	Type	Definition	Frequency	Obligation
16.1	Graduating student	String	Name of the author Format: First name Last name	1	Mandatory

16.2	Publication date	Date	Publication date of the student thesis Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
16.3	Title_Document	String	Title of the student thesis as it appears on the document	1	Mandatory
16.4	Number of pages	Number	Number of pages in the student thesis Format depends on tool, observe institutional writing rules if necessary	0-1	Mandatory/optional
16.5	Abstract	Text	Short text describing the content of the student thesis Should be tailored to the target audience in terms of language, and, if necessary, follow institutional writing rules when rewritten for the timeline	0-1	Mandatory/optional

8.3.16 Technologies

For example, artificial intelligence or mp3.

Table 18: Metadata for the appearance form "Technologies"

Number	Name	Type	Definition	Frequency	Obligation
17.1	Name_Technology	String	Name of the technology Should be known to the target group, could therefore also come from the respective technical language Short, concise	1	Mandatory
17.2	History	Text	History of the technology relevant to the narrative Should be tailored to the target audience in terms of language, and follow institutional writing rules if necessary Includes, e.g., developments or applications	0-1	Mandatory/optional
17.3	Maturity level	String/text	Description of how mature the technology is and how it can be applied Use individual controlled vocabulary Should be tailored to the target audience in terms of language, and follow institutional writing rules if necessary	0-1	Mandatory/optional
17.4	Application area	String/text	Industries or problems in which the technology can be applied Use individual controlled vocabulary	0-n	Mandatory/optional

			If string, multiple functionalities can also be specified Should be tailored to the target audience in terms of language, and follow institutional writing rules if necessary		
17.5	Developer	String	Name of the person who developed the technology Format: First name Last name	0-n	Mandatory/optional

9. Visual aspects

If you create the time scale, i.e., the line on which the events are displayed, yourself, you should decide on an appropriate scale—or make it adjustable. A complete overview of all elements should be possible for timelines that focus on the content information level.

When selecting images, make sure that you are permitted to use them and provide copyright information if necessary. The images should be simple in design to ensure that the timeline is clear and easy to read.

Also, observe any corporate design guidelines for your institution.

10. The timeline is finished - what's next?

A natural characteristic of timelines is that they end in the present. As time progresses, new elements may arise. Make sure that the timeline can be maintained on an ongoing basis. If you link to external content, you should also check regularly to see if it is still accessible.

You can also evaluate your timeline:

- Before making it accessible to the target group: To evaluate the comprehensibility and usability of the timeline, you can conduct thinking-aloud tests or have other data or subject matter experts perform peer reviews. You should also test the technical functionality and check how it displays on different devices, especially mobile ones.
- After making it accessible to the target group: You can use surveys and interviews with users to determine whether you have achieved your communication objective. However, these methods involve a certain amount of effort. With website usage analysis tools, you can determine with paths users use to access the website with the timeline, how long they stay there, or which elements they click on most frequently.

11. Practical example: dPart® - A Digital Twin Framework for the Machining Domain

The timeline "[dPart – from idea to operational tool](#)" (see Figure 8) shows how the recommendations in this guide have been put into practice. It is a scaled [1] interactive timeline implemented with the Histropedia [tool](#). It offers a great degree of interactivity, as users can manipulate it by setting filters, for example. [7] The timeline contains 15 [elements](#), including [publications](#), [projects](#), a [spin-off](#), a [brand](#) and a [standard](#). The elements are very different, so the focus is on the [content information level](#). Each element contains a title, a time stamp, a description, an image and further information.



Figure 8: Timeline "dPart – from idea to operational tool" (as of September 19, 2025)

The target group for the timeline are people from industry who are potential customers of Fraunhofer IPT. The message is the presentation of the typical Fraunhofer way of working. The dramaturgy follows a [linear-nonlinear pattern with linear guidance through a nonlinear structure](#): Users can follow the chronological order of the elements or click individually through the stations of the timeline. When embedded in a website, a moderator's text would recommend following the chronological order in order to discover the entire message. Additionally, it would contextualize the timeline to integrate it into a larger communication framework.

In addition to global metadata, the [metadata concept](#) of the timeline only contains a schema for the content information level of the elements, as this is the main focus. The elements are very different, which means that the focus is on the [dramaturgy pattern](#) and the [story](#) in order to make the message clear. Metadata on the formal information level is added as required.

The greatest difficulties were encountered when gathering information. Many events took place years ago and had to be compiled from various sources (people, files, websites). Embedding websites also proved difficult, as this function is often disabled for security reasons. The solution was a workaround: central support enabled the Fraunhofer IPT's website. A hidden area was created on the website to display all content that cannot be embedded from external websites. The prerequisite for this is that the content may be used, for example, publications with Creative Commons licenses.

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