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## Scrolling into the Newsroom

### A vocabulary for scrollytelling techniques in visual online articles

**Keywords:** scrollytelling, online journalism, visual storytelling, data visualization, design research, infographics, information design, narrative visualization

In recent years, scrollytelling—a method to animate content as a reader scrolls through an article—has become an integral part of online visual storytelling. Despite its popularity, few studies have examined the variety of existing scrollytelling techniques. In addition, scrollytelling is still costly to produce. This study aims to generate a scrollytelling vocabulary for newsrooms and creative agencies. By analysing 50 examples, we have identified granular characteristics of scrollytelling elements, or ‘scrollers’, and grouped them into five standard techniques: graphic sequences, animated transitions, panning and zooming, scrolling through movies, and showing and auto-playing animated content. The study provides information designers, developers, and visual journalists with a vocabulary to experiment with different scrollytelling techniques and implement scrollers faster and more easily.

### 1. Background

Scrollytelling refers to a storytelling format in which visual and textual elements appear or change as the reader scrolls through an online article. When readers scroll, something other than the conventional movement of a document through the viewport happens. Although scrollytelling has become prevalent in online journalism over the last decade (Wolf & Godulla, 2016), it has received little attention in information design literature. A definition with such fuzzy edges might be one reason for this. Scrollytelling being ‘something else’ rather than the default also makes it costly to produce (Seyser et al., 2018; Lu et al., 2021; Sultanum et al., 2021). Apart from the regular challenges faced when researching a story, analysing data, and producing text and visuals, interaction designers need to define the scrolling behaviour, and developers have to create custom implementations (Goldenberg, 2017). Early seminal pieces such as “Snowfall” from the New York Times<sup>1</sup> took months and a dozen people to produce it (Dowling & Vogan, 2014; Greenfield, 2012). Scrollytelling has, therefore, often been associated with long-form journalism<sup>2</sup> (Dowling & Vogan, 2014; Wolf & Godulla, 2016). Scrollytelling is lauded for its ability to bring together text and visual elements into a vertical reading

experience uniquely suited for a small screen (Stolper et al., 2018). However, without a body of knowledge on viable design patterns, scrollytelling has also been criticized for creating bad user experiences, such as ‘scrolljacking’ (Bostock, 2014), and confusing interaction design implementations (Kosara, 2016).

Some attempts have been made to identify and categorise common patterns among scrollytelling elements, or ‘scrollers’. Accordingly, scrollers have been grouped based on their different attributes: type of visual element (Seyser et al., 2018); chart type, type of transition and layout (Sultanum et al., 2021); what readers control by scrolling (Vallandingham, 2015); or the importance of the visual element compared to text (Seyser et al., 2018; Lu et al., 2021). Some authors have built tools that implement a specific configuration of these attributes. Lu et al. found that unit visualizations with animated transitions between states were a common type of scrollytelling (2021), and they narrowed their analysis to examples of this type, extracting design requirements to build a tool. Sultanum et al. (2021) followed a similar approach and found that sequences of charts that are accompanied by text are a prevalent form of scrollytelling. Their analysis of examples defined the design requirements for a scrollytelling tool. In this study, we follow a similar approach to Lu et al.’s and Sultanum et al.’s. However, instead of focusing on a single scrollytelling pattern, we examine atomic characteristics of a variety of scrollers with the aim of creating a library of scrollytelling techniques.

## 2. The problem

At the Swiss daily *Neue Zürcher Zeitung*, scrollytelling techniques have been used in some highly customized articles. The scrollytelling elements or ‘scrollers’ usually took weeks to implement and called for intense

collaborations between programmers, designers, and writers. Lacking an understanding of the recurring modular elements of scrollytelling, we did not evaluate or document design decisions. Therefore, despite the high volume of resources, we failed to reuse code and design patterns in later projects. The lack of a shared language also meant that misunderstandings between designers, developers, and writers were common. The misunderstandings concerned both the general use of scrollytelling and differing interpretations of prototype designs, especially with regard to transitions and animations.

At the same time, all our articles in which scrollers had been used were highly successful. They drew a large readership, boosted reading times, and received positive feedback. Therefore, the question arose: How could we produce articles with high-quality scrollers more frequently? In order to tackle the communication and documentation issues described above, we needed resources and tools that would allow us to: (i) discuss scrollytelling projects across the newsroom using a shared vocabulary; (ii) produce scrollers faster and with fewer resources; and (iii) explore different types of scrollytelling.

Challenges were mainly characterized by the tension between the focus on rapid news production and the space and time needed for thorough conceptual work. Avoiding quick and easy software solutions and instead driving a collaborative knowledge-building process was at the time unfamiliar to many journalists. The journalistic context also meant that our solutions would have to be content-agnostic and accommodate a large variety of topics and visualizations. Finally, the proposal needed to work with our internal charting toolbox<sup>3</sup> and deal with the constraints of our content management system. These integration issues were also the reason why commercial tools—often built for standalone articles—were not compatible with our use case.<sup>4</sup>

### 3. Methodology

To address our lack of a shared language for scrollytelling projects, we focused on finding recurring patterns that could inform future designs. Therefore, we conducted a content analysis on a corpus of 50 online stories (see *Annex 1*).

The corpus consisted of articles that had been collected by the visual department at *Neue Zürcher Zeitung* over the last few years and had been shared in a Slack channel called #inspiration. Most examples were from organizations with large graphics teams such as *The New York Times* and *The Washington Post*, but there were also a few from outlets such as the *South China Morning Post*, *El Pais* or smaller creative agencies. The only criterion was that there should be at least one visual element that reacted to scrolling in a non-standard way. Some articles contained multiple such ‘scrollers’. The articles also used a wide array of media types, ranging from illustration and data visualization to photography and video.

After establishing the collection, we analysed each example. Our leading question was: “How would I describe the example to a developer so that they could recreate it?” Each author defined key characteristics for an average of 15 examples. We then combined those three sets of characteristics into one, creating a unified collection of eight keys and corresponding values. We called these key-value pairs ‘**scrolly-atoms**’. In a second analysis round, we split the corpus among the authors and characterized each scroller in our examples according to the scrolly-atoms. These atoms are described below—keys are set in bold and values are italicized.

**Layout of the visual on desktop:** How much of the browser’s viewport is covered by the visual element. The viewport can be covered *fully* or *partially* by the visual; or the visual can be embedded in the text (*inline*).

**Scroll-behaviour of the visual:** If and how the visual element moves across the viewport when the reader scrolls. The visual can move *vertically*, *horizontally*, *in any direction*, or remain *fixed*.

**Scroll-behaviour of the text:** How the text block (usually a paragraph) moves when the reader scrolls. The text can move *vertically*, *horizontally*, *in any direction*, or remain *fixed*.

**Visual-text-relation:** How many text blocks there are per visual element. There can be one text per visual (*one-to-one*), multiple texts per visual (*one-to-many*), multiple visuals per text (*many-to-one*), or *no text*. Type of visual element: The visual element can be *static* (an image, chart or illustration) or *moving* (an animated or live-action movie).

**Transition type:** If and how the visual element changes on scroll. The visual can *transform* into or be replaced by the next visual (*swap*); or parts of the visual can change so that they appear *highlighted*. If the visual is a continuous sequence (visual element type: moving) it can *play* on scroll.

**Animation type of the transition:** What kind of animation runs during the transition. The visual can *fade* in or out; it can morph (*vector animation*); it can be moved, resized or rotated (*image animation*); it can *pan-and-zoom* in the viewport; or it can resemble a *movie* which is played back.

**Animation control:** The animation can be triggered by the scroll and run for a *fixed duration* from beginning to end; or it can be *scroll-controlled* in that the reader can move forward and backward in the animation through scrolling.

In the next step, we grouped scrollers with similar configurations of scrolly-atoms together and identified five major distinct ‘**scrollytelling techniques**’: **graphic sequence, animated transitions, pan-and-zoom, show-and-play; and moviescroller**.

To verify our findings, we used the kModes-Clustering-Algorithm.<sup>5</sup> The elbow curve indicated that the usefulness of additional categories started to decline after four categories. The groupings show that the configuration of the scrolly-atoms is homogenous for the graphic sequence and the show-and-play techniques. Pan-and-zoom and animated transitions also appear but are more heterogeneous. Finally, as there are few examples of moviescrollers, these are grouped with show-and-play. The verification step, therefore, generally supported the techniques we had identified.

For each scrollytelling technique, we identified the most common configuration of scrolly-atoms

(see *Table 1*). We then described this prototypical disposition in a short paragraph, and this description formed the basis of our library of scrollytelling techniques. Finally, for the most commonly used technique in our newsroom, we created a new scrollytelling tool.

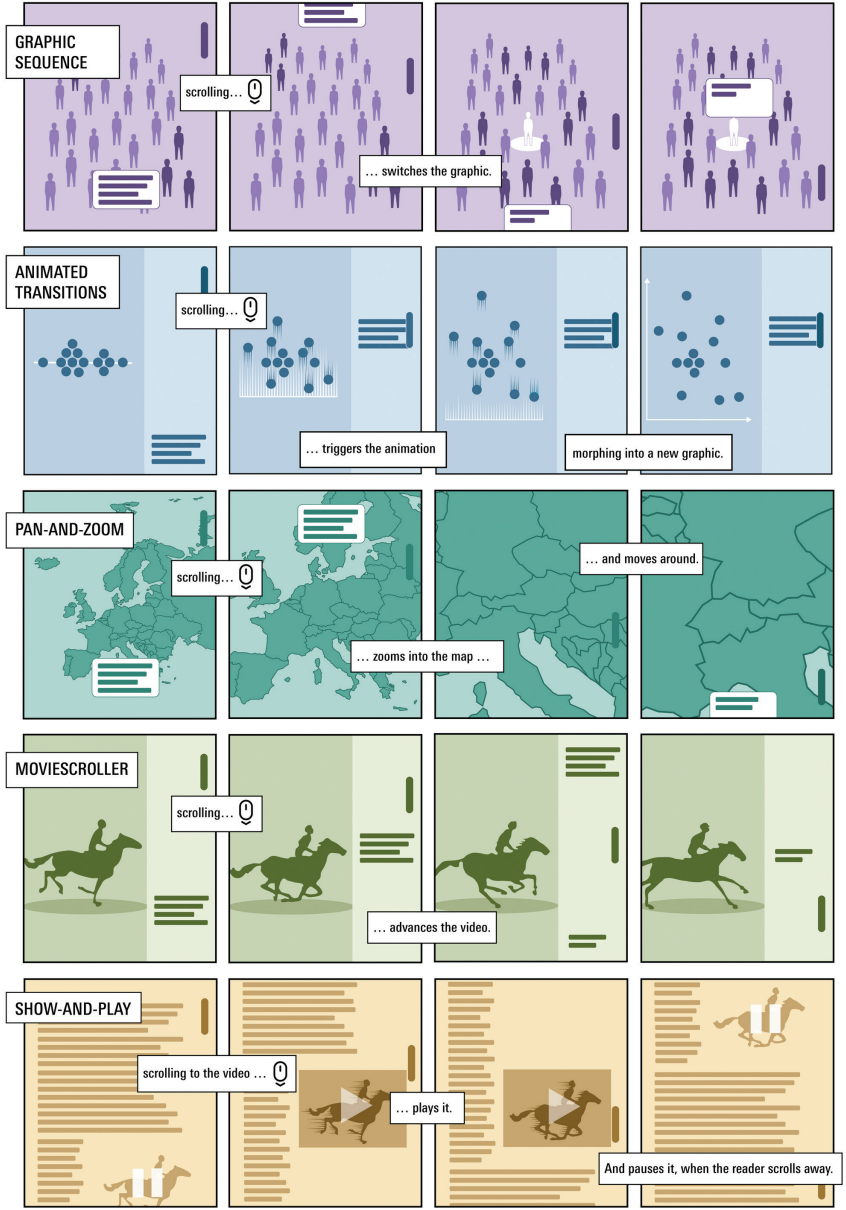
#### 4. A library of scrollytelling techniques

The scrollytelling techniques (see *Figure 1*), as well as possible implementation strategies and examples, are documented in our public style guide.<sup>6</sup> This scrollytelling library is aimed primarily at designers who create visuals for scrollers and developers who implement them. The secondary target audience is the editorial staff that collaborates with visual journalists and developers on the creation of scrollytelling articles. The techniques and corresponding prototypical examples are briefly described in the following paragraphs.

**Table 1.** Each scrollytelling technique has a typical configuration of scrolly-atoms. Exceptionally, there may, for some keys, be no clear majority value. In these cases, we denoted the value as ‘any’

Technique	Layout of the visual	Scroll-behavior of the visual	Scroll-behavior of the text	Visual-Text-Relation	Type of visual	Transition type	Animation type of the transition	Animation control
Graphic sequence	Full	Fixed	Vertical	One-to-one	Static	Swap	Fade	Fixed duration
Animated transitions	Partial	Fixed	Vertical	One-to-one	Static	Transform	Vector animation	Fixed duration
Pan-and-zoom	Full	All-directions	All-directions	One-to-many	Static	Transform	Pan and zoom	Scroll-controlled
Moviescroller	Any	Fixed	Vertical	One-to-many	Moving	Play	Movie	Scroll-controlled
Show-and-play	Any	Fixed	Vertical	Any	Moving	Play	Movie	Fixed duration

## Five scrollytelling techniques



**Figure 1.** A visual explanation of the five scrollytelling techniques

### 4.1 Graphic sequence

In a graphic sequence, the visual stays fixed in place. As the user scrolls, text blocks move over the visual, and are replaced with a new one. The transition is usually animated with a slight fading animation (see *Figure 2*).

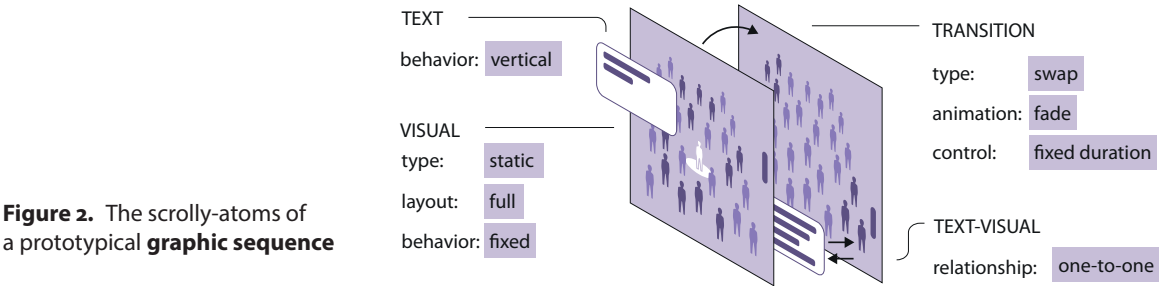
This technique is often used for showing and highlighting information on a visualization step by step,<sup>7</sup> and works well if the dimensions of visuals are kept the same throughout the scroller. Other examples use photographs to make a before-after comparison.<sup>8</sup>

A prototypical example by El Pais<sup>7</sup> shows an isometric illustration of a living room with six people in it, one of which is infected with Sars-CoV-2. At each step, the scroller goes on to present a scenario: how many people would get infected if they wore masks, or if they opened the windows. The people are highlighted either in red or blue to show if they were infected or not.

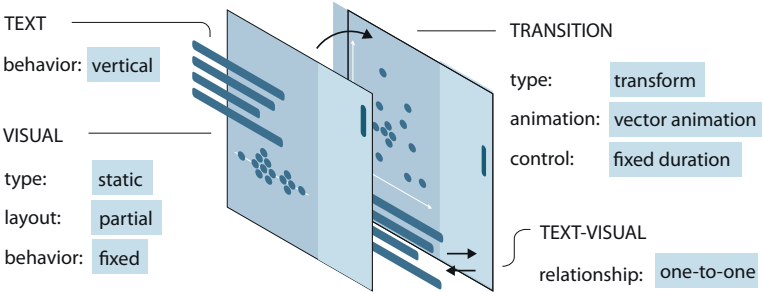
We have used the graphic sequence technique frequently in customized articles (see *The Problem*). So, we built a new tool for our charting toolbox. This tool allows visual journalists to create graphic sequences with ease. Visual journalists are now able to upload visuals for different device sizes and add text to each one of them. They can also activate or deactivate the fading transition between the visuals.

### 4.2 Animated transition

In this scrollytelling technique, visuals stay fixed as the text scrolls alongside. Animation is used to transition from one visual to another, morphing between two vector graphics. The morphing is triggered at a certain scroll position and typically plays for a fixed duration (see *Figure 3*).



**Figure 2.** The scrolly-atoms of a prototypical **graphic sequence**



**Figure 3.** The scrolly-atoms of a prototypical **animated transition** scroller

This technique is often used to build up complex visualizations step by step, adding a dimension with each stage.<sup>9</sup> Another common use case is to show different aspects of the data by regrouping symbols in a unit visualization.<sup>10</sup> This technique is also used for transitioning from one visualization to another<sup>11</sup> or for animating paths on a map.<sup>12</sup>

A prototypical example<sup>9</sup> starts with a beeswarm-plot, showing how long it takes to read privacy policies of different, well-known websites. The next step adds ‘reading difficulty’ on the y-axis. The points from the beeswarm plot spread out vertically to form a scatter plot. Finally, a time-dimension is introduced: a line animates to connect points from different years, ending up as a connected scatter plot.

4.3 Pan-and-Zoom

The pan-and-zoom technique allows the user to control which section of the visual is visible in the browser’s viewport. Scrolling causes the visual to zoom and/or pan. The zooming-/panning-movement is animated and the speed of the animation is tied to how fast readers are scrolling (see *Figure 4*).

The main use of this technique is for navigating through maps.<sup>13</sup> Other uses include parallax scrolling<sup>14</sup> and zooming in on different parts of a photograph.<sup>15</sup>

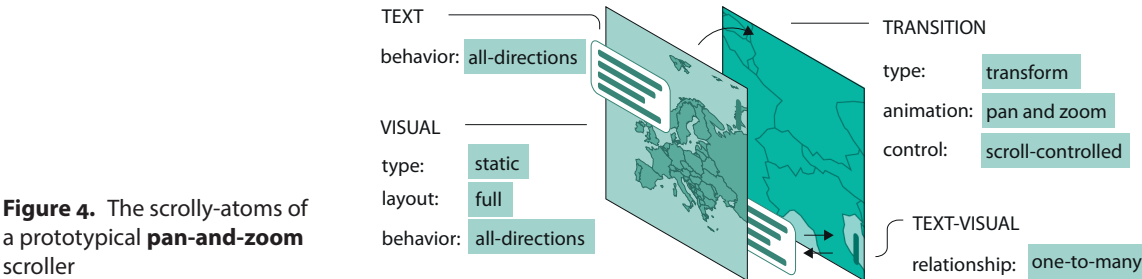
A prototypical example<sup>13</sup> shows the effects of the 2019 Mississippi floods. Firstly, a section of the Mississippi river, its north area, is shown with labels indicating what has been destroyed. As the reader scrolls, the map moves along the river southwards showing further places that have been affected by the floods.

4.4 Moviescroller

A moviescroller allows the user to scroll through moving images. Other than with animated transitions, the image sequence is continuous, and there are no clearly defined start and end states (see *Figure 5*).

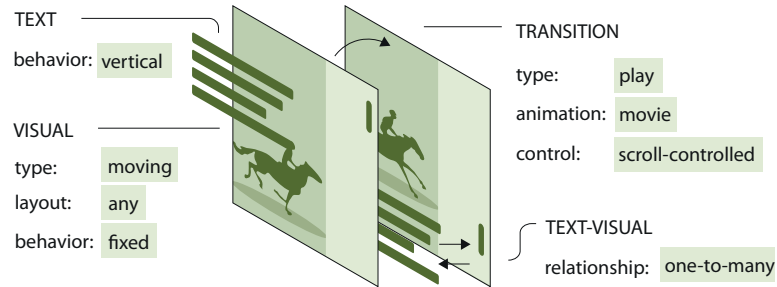
Moviescrollers are often used for tracking shots around 3D-models.<sup>16</sup> Another use case is for annotating video footage<sup>17</sup>

A prototypical example<sup>16</sup> explains the movements of olympic gymnast Sunisa Lee. Here, scrolling controls the playback of a 3D-animation. In the ‘Nabieva-move’, Lee swings around a bar, lets go of the bar, and grabs it again, just in time before she falls. By scrolling, the reader can

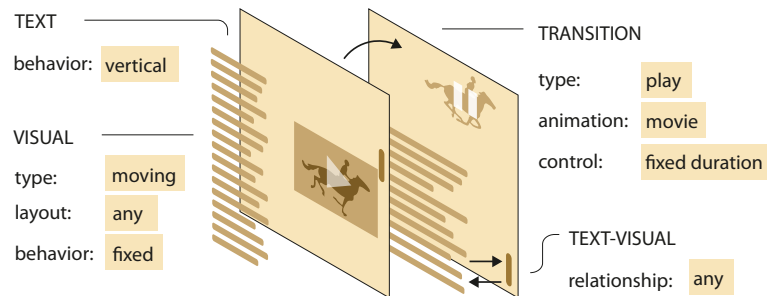




**Figure 5.** The scrolly-atoms of a prototypical **moviescroller**



**Figure 6.** The scrolly-atoms of a prototypical **show-and-play** scroller



advance through the movement slowly. Text blocks scroll into view at crucial moments to explain what is happening.

#### 4.5 Show-and-Play

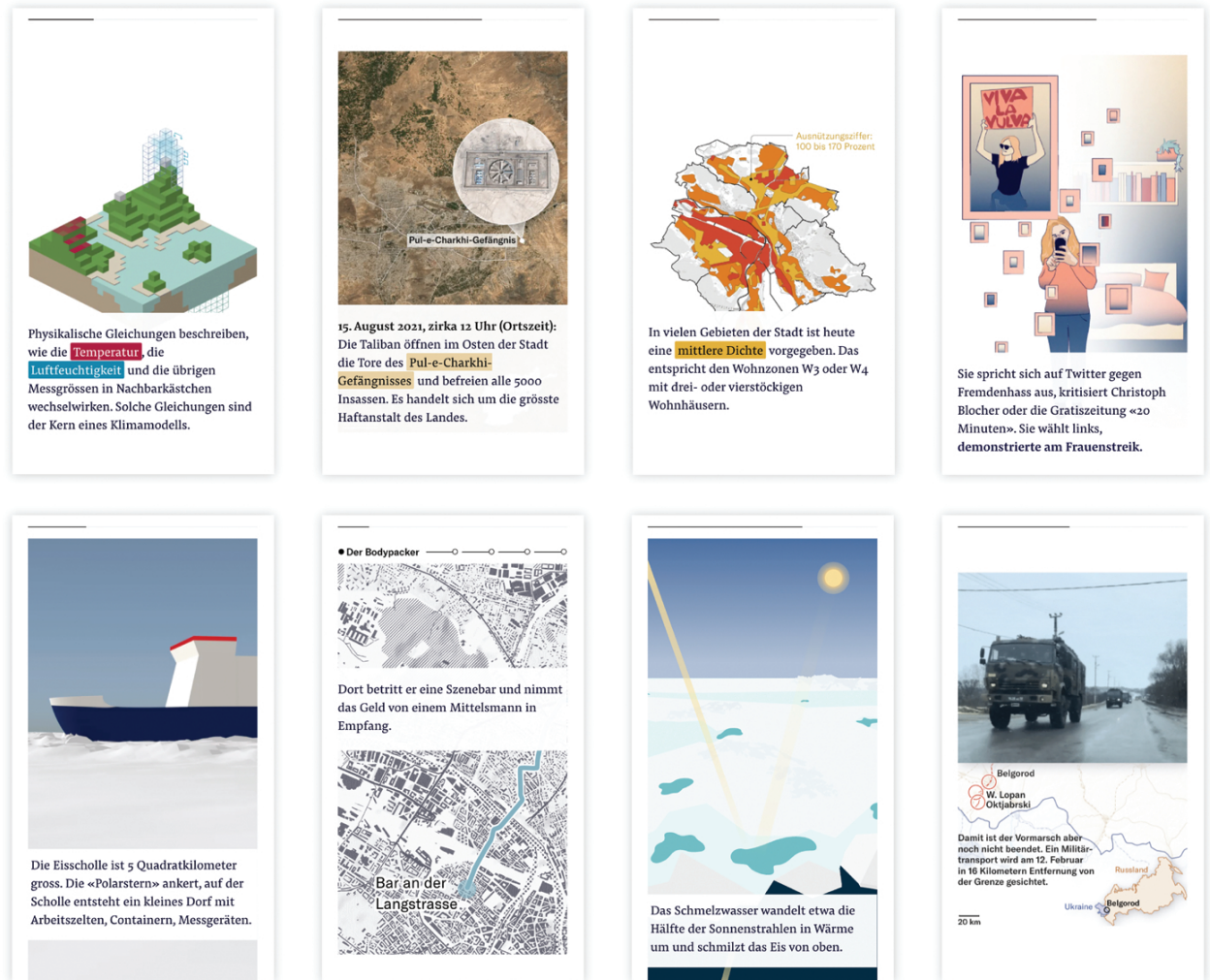
The show-and-play technique makes elements appear on screen as the users scroll. These elements can be static, but mostly they are animated GIFs or videos. When these elements appear, they automatically start to play in a loop. Playback stops, as soon as the reader scrolls away (see *Figure 6*).

Many of the examples that implement show-and-play use videos with reduced motion to set a mood and bring an image to life.<sup>18</sup> Others use it to start playing animations that show, for example, change over time.<sup>19</sup>

ProPublica uses show-and-play videos<sup>18</sup> to present different buildings on a Hawaiian beach. House owners built walls towards the sea, making the sandy beaches disappear. The looped videos show clearly how the waves hit against these 'seawalls'.

The library of scrollytelling techniques is used in our newsroom on a daily basis. Developers, visual journalists, and editors collaborate using a shared vocabulary to explore different types of scrollytelling. Furthermore, thanks to our internal graphic sequence tool, non-coding, visual journalists publish scrollytelling articles almost every week. All this means that scrollers are now being created with ease and in a matter of days. This has allowed us to move scrollytelling from a long-form to a news format (see *Figure 7*).





**Figure 7.** The top row shows four graphic sequences—produced with the tool we implemented according to our research. The bottom row shows examples of a moviescroller, pan-and-zoom, animated transitions and show-and-play. All of them were designed and developed with the descriptions of the respective techniques in mind

## 5. Conclusion

Because scrollytelling is a non-standard behaviour, it is seen as labour-intensive and costly to produce. However, not all scrollers are that unique. Visualization researchers have noted recurring patterns and have used them to build tools that make it easier to create scrollers. These works consciously limited their scope to one scrollytelling pattern.

This study identifies and describes five standard scrollytelling techniques. At Neue Zürcher Zeitung, we frequently use these techniques to discuss and implement scrollytelling articles. These techniques have allowed us to produce scrollers faster and at the same time introduce variety in our digital storytelling.

The techniques cover many of the scrollers that are being produced by newsrooms, but not all of them. As the field evolves, it is very well possible that new patterns will gain traction. Finally, each technique has different usability pitfalls. Further research into how users read and understand scrollers may refine the scrolly-atoms and lead to a solid best practice for scrollytelling.

Newsrooms can use the vocabulary and the definitions elaborated in this paper to inform the design of their own scrollers. We also hope that this work may inspire others to reflect on, document, and share their design patterns.

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## Notes

1. “Snow Fall – The Avalanche at Tunnel Creek”: <https://www.nytimes.com/projects/2012/snow-fall/index.html>
2. Long-form journalism refers to longer-than-usual articles, often with in-depth, expository reporting.
3. Q-Toolbox: <https://q.tools>
4. One of the commercial scrollytelling tools we had first considered for our use case was Shorthand (<https://shorthand.com/>).
5. The kModes algorithm is a clustering method that maximizes similarity within a given number of groups. A more detailed description can be found here: <https://www.analyticsvidhya.com/blog/2021/06/kmodes-clustering-algorithm-for-categorical-data/>. We use the Python kModes-library: <https://pypi.org/project/kmodes/>
6. NZZ Visuals – Styleguide: <https://nzzdev.github.io/Storytelling-Styleguide/#/einfuehrung>
7. “A room, a bar and a classroom: how the coronavirus is spread through the air”: <https://elpais.com/especiales/coronavirus-covid-19/a-room-a-bar-and-a-class-how-the-coronavirus-is-spread-through-the-air/>
8. “A city transformed”: <http://graphics.wsj.com/rio-city/>
9. “We Read 150 Privacy Policies. They Were an Incomprehensible Disaster”: <https://www.nytimes.com/interactive/2019/06/12/opinion/facebook-google-privacy-policies.html>
10. “1000 Times Gold”: <https://www.washingtonpost.com/graphics/sports/olympics/the-1000-medals-of-the-united-states/>
11. “Why EU Regions are Redrawing Their Borders”: <https://pudding.cool/2019/04/eu-regions/>
12. “The race to save the River Ganges”: <https://graphics.reuters.com/INDIA-RIVER/010081TW39P/index.html>
13. “The Great Flood of 2019”: <https://www.nytimes.com/interactive/2019/09/11/us/midwest-flooding.html>

14. “Leben im Zürichsee”: <https://interaktiv.tagesanzeiger.ch/2020/zuerichsee/>
15. “Rose Garden ceremony attendees who tested positive for coronavirus”: <https://www.washingtonpost.com/graphics/2020/politics/coronavirus-attendees-barrett-nomination-ceremony/>
16. “Sunisa Lee – the Gymnast”: <https://www.nytimes.com/interactive/2021/sports/olympics/suni-lee-gymnastics.html>
17. “How a Massive Bomb Came Together in Beirut’s Port”: <https://www.nytimes.com/interactive/2020/09/09/world/middleeast/beirut-explosion.html>
18. “Hawaii’s Beaches are disappearing”: <https://projects.propublica.org/hawaii-beach-loss/>
19. “2014 Was the Hottest Year on Record”: <https://www.bloomberg.com/graphics/2014-hottest-year-on-record/>

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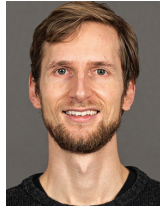
Example	Year	Link	Medium	Visual layout	Scroll behavior of visual	Scroll behavior of text	Visual text relation	Visual type	Transition type	Animation type	Animation control	Technique
The sea we use to see the sea ranges	2018	<a href="https://graphics.nytimes.com/story/2018/08/18/197000/index.html">https://graphics.nytimes.com/story/2018/08/18/197000/index.html</a>	Journal	Vertical	Vertical	Vertical	Many to One	Static	Transfers	Vector animation	Fixed duration	Cluster 1 generally corresponds to the pan and zoom techniques. But not always.
We now have the Sea of Cortez	2019	<a href="https://graphics.nytimes.com/help-center/animation.html">https://graphics.nytimes.com/help-center/animation.html</a>	WOL	Fall	Horizontal	Horizontal	One to One	Static	Highlight	Image animation	Scroll-controlled	Pan and zoom
Am I helping to protect the NHS?	2020	<a href="https://www.bbc.com/news/health-52848434">https://www.bbc.com/news/health-52848434</a>	BBC	Fall	Vertical	Vertical	One to Many	Static	Highlight	Image animation	Scroll-controlled	Other
Am I helping to protect the NHS?	2020	<a href="https://www.bbc.com/news/health-52848434">https://www.bbc.com/news/health-52848434</a>	BBC	Fall	Horizontal	Horizontal	Many to One	Static	Highlight	Image animation	Scroll-controlled	Other
The Great Flood of 2019	2019	<a href="http://www.nytimes.com/interactive/2019/08/12/us/politics/floods.html">http://www.nytimes.com/interactive/2019/08/12/us/politics/floods.html</a>	NyTimes	Fall	Pan and zoom	Vertical	None	None	Static	Transfers	Pan and zoom	Pan and zoom
A 500-year sea	2019	<a href="https://www.nytimes.com/interactive/2019/08/12/us/politics/floods.html">https://www.nytimes.com/interactive/2019/08/12/us/politics/floods.html</a>	NyTimes	Fall	Pan and zoom	Vertical	One to Many	Static	Transfers	Pan and zoom	Scroll-controlled	Pan and zoom
Sea in the Arctic	2020	<a href="https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html">https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html</a>	NyTimes	Fall	Pan and zoom	Vertical	One to Many	Static	Transfers	Pan and zoom	Scroll-controlled	Pan and zoom
What's the Sea and Why is it in the Age of Covid-19?	2020	<a href="https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html">https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html</a>	NyTimes	Fall	Pan and zoom	Vertical	One to Many	Static	Transfers	Pan and zoom	Scroll-controlled	Pan and zoom
Mapping America's most populated cities and how they look inside	2021	<a href="https://www.nytimes.com/interactive/2021/02/24/us/politics/floods.html">https://www.nytimes.com/interactive/2021/02/24/us/politics/floods.html</a>	Washington Post	Fall	Pan and zoom	Vertical	One to One	Static	Transfers	Pan and zoom	Fixed duration	Pan and zoom
What's the Sea and Why is it in the Age of Covid-19?	2020	<a href="https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html">https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html</a>	NyTimes	Fall	Pan and zoom	Vertical	One to Many	Static	Transfers	Pan and zoom	Scroll-controlled	Pan and zoom
What's the Sea and Why is it in the Age of Covid-19?	2020	<a href="https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html">https://www.nytimes.com/interactive/2020/07/27/us/politics/floods.html</a>	NyTimes	Fall	Pan and zoom	Vertical	One to Many	Static	Transfers	Pan and zoom	Scroll-controlled	Pan and zoom
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### About the authors

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