# Data-Driven Narratives Cards: A Card-Based Design Activity for Participatory Data Storytelling

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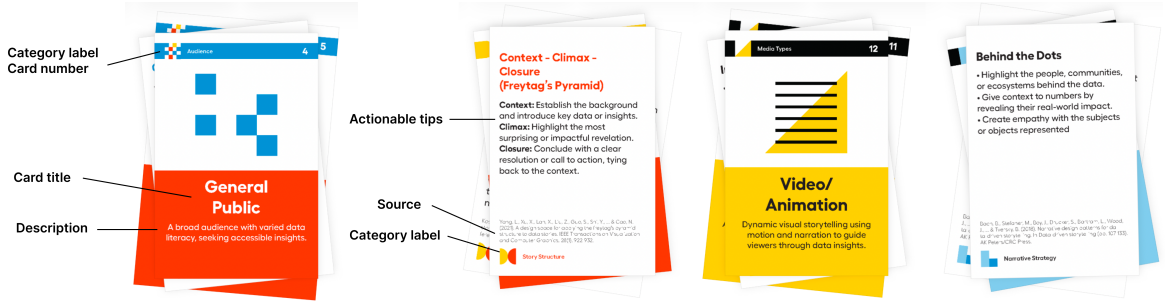


Figure 1: Example DDN Cards showing front and back structure across three categories. Front faces show the category label and card number, an abstract geometric illustration whose visual vocabulary is consistent within each category, the card title, and a short concept description. Back faces show the card title, actionable tips for applying the concept in a workshop setting, the source reference grounding the content in research or practitioner literature, and the category label. Cards shown left to right: General Public (Audience), Context-Climax-Closure (Story Structure), Video/Animation (Media Types), and Behind the Dots (Narrative Strategy).

**Abstract**

*Data-Driven Narratives (DDN) Cards are a 32-card design activity supporting groups of professionals who work with data in collaboratively designing data-driven narrative concepts. The cards translate knowledge from academic research on narrative visualization into a structured, point-of-use format that mixed-expertise groups can engage with during a facilitated session, with support from a facilitator with visualization expertise and a domain expert close to the data. Organized across two sessions covering eight categories, the cards provide a shared vocabulary and tangible artifacts that enable groups to make collective narrative design decisions. The activity has been deployed in a science communication context involving a research institution working on energy data, producing five distinct narrative concepts.*

**CCS Concepts**

• ***Human-centered computing*** → ***Visualization design and evaluation methods;***

## 1. Introduction

Many professionals who work with data, including scientists, analysts, policy makers, and data scientists, are regularly expected to communicate findings to non-specialist audiences, yet rarely develop the narrative skills to do so effectively. Two bodies of knowledge exist that could support them: practitioner books on data storytelling [Kna15, Dyk19] and academic research on narrative visualization [BSB*18, OH18, SH10]. Practitioner books are typically written for people investing in long-term skill development, not for a researcher who needs to communicate findings from a single project to a specific audience. Research papers provide rigorous frameworks for understanding how data stories are structured, but they are written for an academic audience rather than as practical tools for people in the act of designing one. This gap reflects a broader challenge in extending visualization education beyond trained practitioners to domain experts working with data [BKR*23].

Data-driven narratives often involve multiple stakeholders. The people who collected the data, the people who need to communicate it, and the people who will design the final artifact are

frequently different individuals with different disciplinary backgrounds. Narrative decisions in these contexts are inherently collective, yet mixed-expertise groups typically lack shared vocabulary to negotiate them. Without a common language, design conversations stall not because of disagreement but because participants cannot articulate their preferences in terms others recognize. This challenge becomes more pressing with the increasing use of AI-supported tools in data storytelling [LWQ24], which can generate or structure narratives but still require critical discussion and shared understanding among stakeholders to interpret, evaluate, and adapt these outputs.

DDN Cards are a 32-card design activity organized across eight categories and two sessions, designed for use by mixed-expertise groups with facilitator and domain expert support. The cards operationalize knowledge from the literature into a format usable in a group setting, providing a structured scaffold for constructing a data narrative and a shared vocabulary that makes co-design of narrative decisions possible within a single session. The cards are not a standalone teaching tool. They assume a facilitator with visualization or data storytelling expertise who introduces the concepts through a short presentation with worked examples before card selection begins, and a domain expert close to the data who is available throughout. The activity lowers the barrier for the rest of the group to participate substantively, not for everyone in the room. The need for such scaffolding is well-documented: studies of data storytelling in professional contexts show that stakeholders can engage meaningfully with explanatory visualization features when these are introduced through structured activities, but typically lack the design literacy to deploy those features independently [MMM24].

## 2. Related Work

Existing card-based tools at the intersection of data visualization and design education target different stages of the design process. VizItCards [HA17] and Vizionaire [BS25] focus on visualization literacy, asking participants to match types to scenarios or to learn encoding principles. Drawagram [PS25] emphasizes sketching skill. VisFutures [DPO*23] engages visualization researchers in speculative thinking. DDN Cards address a stage these tools do not cover: the construction of a narrative from data participants already have, with collaborators from outside visualization.

DDN Cards adopts the audience-first, pipeline oriented practitioner frameworks of Knaflic [Kna15] and Dykes [Dyk19]. The academic frameworks we draw from are Bach et al. [BSB*18], Ojo and Heravi [OH18], Segel and Heer [SH10], Kosara [Kos17], Yang et al. [YXL*21], and Diakopoulos [Dia18]. Studies of data storytelling in professional contexts show that when stakeholders are exposed to explanatory visualization features in a structured setting, they can identify key insights more efficiently than from exploratory visualizations alone, but they do not spontaneously apply the underlying principles when designing their own communications [EMMBS*18, MMM24]. DDN Cards are designed for this population: people who can recognize a good data story when they see one but may lack the operational framework for constructing one.

Co-design approaches emphasize the value of involving stakeholders with different expertise in shared design decisions [SS08]. Physical artifacts play a recognized role in supporting collaborative sense-making across disciplinary boundaries: tangible, nameable objects give participants a shared referent that stabilizes conversation and allows concepts to be negotiated rather than simply asserted [HGH*17, SG89]. Card-based design activities have been used in participatory design contexts as generative tools that prompt ideation and structure discussion [BM04, ÇNM25]. DDN Cards build on this tradition by providing tips that guide participants in developing and articulating narrative concepts.

The ethical dimensions of narrative design decisions are particularly difficult to surface. Research on data storytelling in learning analytics contexts found that participants only became aware of the manipulative potential of visualization choices after engaging in a hands-on design activity, not through prior reflection [MMM24]. Research on visualization design practice shows that technically correct visualizations can systematically mislead through structural choices. Axis scaling, implied relationships between variables, and interaction defaults can foreground certain readings over others, without any intent to deceive [Cor19,MKC20]. These failure modes are particularly likely in mixed-expertise groups where domain experts lack visualization literacy and designers lack domain knowledge. The Ethical Considerations category in DDN Cards addresses this directly as a group, making these questions a required step in the narrative planning process rather than an afterthought.

## 3. Goals and Outcomes of the Activity

The goal of the DDN Cards activity is for each participating group to produce a data-driven narrative concept: a structured proposal specifying a target audience, a narrative strategy, a story structure, a media format, and a set of ethical considerations relevant to their data. The activity ends when each group has presented their narrative concept to the other participants and received feedback.

A session can be considered successful when groups produce narrative concepts that are grounded in the available data, differentiated by audience and strategy, and developed enough to serve as a brief for subsequent visualization or communication design work. The diversity of concepts across groups, rather than convergence on a single solution, is a sign that the cards are functioning as intended.

## 4. Procedure

The activity runs across two sessions separated by an asynchronous working period. Session 1 takes about 90 minutes with 4 to 6 domain experts. Session 2 is a 4-hour workshop including breaks, accommodating 12 to 20 participants in mixed groups.

### Session 1: Audience and Insights (90 minutes)

- Invite 4 to 6 domain experts or stakeholders who are close to the data.
- **Audience and goal mapping (45 minutes).** Facilitate a structured discussion to identify the target audiences for the data communication effort and the communication goals associated with each. The Audience cards can be used by the facilitator to structure this conversation.


Figure 2: Card taxonomy overview showing all eight categories and card counts.

- **Insight surfacing (45 minutes).** With audiences and goals in view, work with domain experts to surface the key findings or data points most relevant to each. The Observations cards (Follow a Question, Find a Theme, Ask 5W Questions) prompt different angles on the data.
- Document outputs as a set of audience definitions and candidate insights.

#### Between Sessions: Insight Document

- Following Session 1, domain experts work asynchronously over an agreed period to populate a shared Insight Document. The document, structured as a spreadsheet, captures specific insights organized around the audience directions identified in Session 1. For each insight, domain experts note the narrative direction it supports, the relevant claim or question it raises, supporting facts and evidence, suggested data sources, and any charts or visualizations already available. This document becomes the primary data resource participants use in Session 2. An example of the Insight Document format from the Future of Electricity deployment can be found in supplementary materials.

#### Session 2: Story Co-Design Workshop(4 hours)

- **Introductions, Data-Driven Narratives presentation, and design brief (1 hour).** The facilitator introduces the activity and the card categories relevant to the co-design task: Audience, Media Types, Narrative Strategies, Story Structures, and Ethical Considerations. Each category is briefly explained, with worked examples drawn from published data stories that illustrate strategies less self-evident from a short prompt, such as, Behind the Dots or Defamiliarize. The domain expert then walks participants through the Insight Document, presenting the key findings and the narrative directions they support. Participants ask clarifying questions to ensure that all participants, regardless of disciplinary background, share an understanding of what the data shows and what it cannot support.
- **Group ideation (1 hour).** Participants are divided into groups of 3 to 5, each including, where possible, members from different disciplinary backgrounds. Each group is assigned a target audience from the outputs of Session 1. Groups review the relevant Insight Document entries, use the Observations cards as prompts to identify the core insight or question their narrative will address, then select one Audience card, one Media Type card, one or two Narrative Strategy cards, one Story Structure card, and at least one Ethical Considerations card. Selections are made through discussion: groups should be able to articulate why each card applies to their narrative direction. The domain expert and facilitator circulate during this step. The domain expert answers questions about the data; the facilitator confirms whether card selections are being applied in ways consistent with the underlying concepts.
- **Concept presentation preparation (1 hour).** Each group prepares a brief presentation of their narrative concept, covering the insight they identified, the audience they are designing for, the strategy and structure they chose, and the media format they propose.
- **Presentations and reflections (30 minutes, 5 to 10 minutes per group).** After each presentation, the other participants and the domain expert respond with questions and feedback. The facilitator guides discussion toward whether the narrative concept is grounded in the data, appropriate for the audience, and feasible within the proposed media format. The session closes with a brief plenary on what the different concepts have in common and where they diverge.

## 5. Usage and Variations

### 5.1. Reference Deployment: Future of Electricity

DDN Cards were developed in the context of a collaboration between the Moholy-Nagy University of Art and Design and the HUN-REN Centre for Energy Research, working on electricity consumption and production data for Hungary. The institution needed to communicate research findings to two distinct audiences: the general public and policymakers. The full activity was implemented from November 2023 to February 2024. The Audience and Insights session involved 4 domain experts and produced 4 target audience definitions with associated communication goals. Over the following two weeks, domain experts populated the Insight Document with specific findings, data sources, and available charts organized around the two primary audience directions. The Story Co-Design Workshop brought together 16 participants from design, data science, and research backgrounds working in mixed groups.

The workshop produced 5 narrative concepts, each reflecting a distinct combination of audience, narrative strategy, and media type choices made through card selection and group discussion.

To illustrate what a produced concept looks like at the close of the activity, we describe one in detail. One group, working from policymaker-oriented insights about renewable energy economics, selected the Compare and Make a Guess narrative strategy

cards and the Question-Fact-Explanation-Conclusion story structure card. Their proposed concept was an interactive quiz that walks policymakers through cost comparisons of energy sources, framing each comparison as a question whose answer is revealed alongside the data.

Other concepts included an experiential approach to energy reliability using temporary power outage simulations, and a board game format for public engagement with energy consumption. Several of these media formats were not represented in the card set at all, which is discussed in Section 6. The diversity of outputs across groups working from the same data and the same card set suggests that the cards function as generative rather than prescriptive tools.

The presence of a domain expert throughout the co-design workshop was a key factor in the session's success. Participants regularly encountered questions about the data that could not be answered from the Insight Document alone: what specific numbers meant in context, what findings the research community considered surprising, and what claims the data could and could not support. Having the domain expert available to field these questions in real time kept the ideation grounded and prevented groups from developing narratives that were compelling in form but unsound in content.

### 5.2. Variations

The reference deployment described above is one configuration; the activity can be adapted in other ways depending on context.

**Condensed variant for groups familiar with the data.** When participants already work closely with the data, Session 1 and the Insight Document phase can be replaced with a structured brief that participants read in advance. Session 2 runs as described, reducing the total time investment to a single half-day workshop.

**Workshop or educational variant.** For settings such as a one-session workshop or a course module, the facilitator prepares both the audience definitions and a completed Insight Document in advance. Participants begin directly at the Session 2 ideation step. This compresses the activity to roughly 2 to 2.5 hours, depending on whether the concept presentation step is retained.

**Without a domain expert in the room.** For contexts in which a domain expert cannot attend the co-design workshop, the Insight Document should be more extensive, and the facilitator should be briefed in advance on the data, the context, and the questions participants are most likely to raise.

## 6. Reflection and Conclusion

In the Future of Electricity deployment, the 5 narrative concepts produced across groups covered a range of audiences, strategies, and formats that the institution had not previously considered. Participants from design and data science backgrounds introduced narrative approaches that the researchers had not encountered, while the researchers and domain expert kept the concepts grounded in what the data could actually support. The activity produced actionable briefs that could serve as starting points for subsequent projects.

The activity requires a facilitator with experience in data visualization or data storytelling. This expertise is needed at two distinct points: before the session, to prepare and deliver a short teaching presentation introducing each card category with worked examples drawn from published data stories, and during the session, to confirm that card selections are being applied in ways consistent with the underlying concepts. The cards themselves are not designed to teach; they are conversation prompts that work because the concepts have been introduced beforehand and a knowledgeable person is available during ideation. Some card concepts are intuitive enough that the short tip on the card is sufficient such as Compare or Rhetorical Question. Others, such as Behind the Dots, Defamiliarize, or Silent Data, are difficult to grasp from text alone and rely heavily on the worked example shown in the pre-session presentation. A companion resource with annotated examples for each card is in development and would reduce reliance on facilitator expertise in future deployments. This pattern of facilitator-dependence reflects a broader observation across creative visualization activities, which often surface tensions that require facilitator judgment to navigate [RBB*22]. Input from a domain expert during the co-design workshop is just as important, especially when addressing questions about the domain and the data.

Notably, several groups proposed media formats that were not represented in the card set at all. The power outage simulation and the board game, for instance, go well beyond the Media Type cards on offer, which cover more conventional data communication formats. Rather than constraining participants to the options on the cards, the Media Type category appeared to function as a starting point for creative divergence. Domain experts responded positively to these proposals, finding them inventive and contextually appropriate for their audiences. This suggests that the card set may be most effective not when it is followed prescriptively but when it provides just enough structure to prompt participants to think beyond their default assumptions, including assumptions about what a data story can look like. Future iterations of the activity could make this explicitly a goal, for instance by framing the Media Type cards as examples rather than a fixed list and encouraging groups to propose formats the cards do not anticipate.

The current card set covers the Observations, Audience, Media Types, Narrative Strategies, Story Structures, and Ethical Considerations categories. The framework is not intended as exhaustive and remains open to alteration as further deployments generate evidence about what participants need. Chart selection is deliberately out of scope: DDN Cards are designed for use by people who already have data visualization skills, and dedicated resources for chart selection, such as the Graphic Continuum Flash Cards [Sch16], already address this well. Other possible extensions include visual perception principles, cognitive load considerations, and a digital companion to the physical cards.

A current challenge is the breadth of the card set relative to the time available in a single workshop session. With 32 cards across eight categories, there is more than most groups can engage with carefully in two to three hours. Facilitators should be prepared to direct groups toward the most relevant categories for their specific context rather than expecting groups to work through all cards.

A limitation of the current Ethical Considerations cards is that they focus primarily on visualization-level decisions: axis integrity, visual mapping, implied relationships, context and annotation, in-

teractivity defaults. Yet the most consequential ethical decisions in data storytelling are often made earlier, at the level of which insights are foregrounded, which are left out, and how the data is framed for the chosen audience. A future iteration could add cards covering framing, selection, and omission as planning-stage ethical considerations, separate from the execution-stage cards. This responds to research in adjacent contexts showing that participants often only become aware of the manipulative potential of narrative choices through hands-on activity, not through prior reflection [MMM24].

## 7. Material Overview

The DDN Card set in its current form consists of 32 cards organized across eight categories. The Observations category contains 3 cards: Follow a Question, Find a Theme, and Ask 5W Questions. The Audience category contains 3 cards: General Public, Executives, and Experts. The Media Types category contains 6 cards: Magazine Style, Annotated Chart, Slide Show, Scrollytelling, Interactive Dashboard, and Video/Animation. The Narrative Strategy category contains 13 cards covering Compare, Repetition, Make a Guess, Rhetorical Question, Break the Norm, Behind the Dots, Make It Concrete, Familiarize, Defamiliarize, Silent Data, Incorporate the Audience, Break the Fourth Wall, and Gradual Reveal. Annotated examples for each Narrative Strategy card, drawn from published data stories, are available on the companion Miro board linked in the supplementary materials. The Story Structure category contains 2 cards: Question-Fact-Explanation-Conclusion and Context-Climax-Closure (Freytag's Pyramid). The Ethical Considerations category contains 5 cards: Axis Integrity, Visual Mapping, Implied Relationships, Context and Annotation, and Interactivity Defaults.

Each card has a front face showing the card title, a short description of the concept, and an abstract geometric illustration. Cards within the same category share a visual family resemblance through variations of a common shape vocabulary, while cards across categories are visually distinct in terms of color combinations and shapes. Each card back shows the card title, a set of actionable tips for applying the concept, and the reference from which the card content was drawn. The reference at the bottom of the card provides an entry point for those who wish to engage more deeply with the source material.

The activity also requires an Insight Document prepared by domain experts between Session 1 and Session 2. This document is structured as a shared spreadsheet and captures specific insights organized around the audience directions identified in Session 1. For each insight, the document records the narrative direction it supports, the relevant claim or question, supporting facts and evidence, data sources, and any charts or visualizations available. Figure **??** shows an example from the Future of Electricity deployment. All supplementary materials, including the DDN Card set, the Insight Document template, and the companion Miro board with annotated examples, are openly available at:
https://osf.io/gpq3z/



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