Novel methods of analysing data and creating scenarios – Case studies

Advancing Delphi Studies by exploring visual methods for future scenario representation

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Background

premise

The ability to generate a diverse range of high-quality future perspectives, coupled with the skill to apply emerging insights effectively, is highly valued across businesses, governments, educational institutions, non-profit organizations, and even individuals in today's rapidly evolving world. There has perhaps never been a time in human history where strategic foresight is more needed (Hines & Bishop - 2013).

future studies

Methodology that focus on imagining, exploring, and preparing for future challenges and changes before they fully emerge (Foresight, Scenario Planning, Adaptive Policies, ...).

scenarios

Definition: structured, plausible descriptions of potential futures, based on current trends, potential developments or on the knowledge, insights, and judgments of subject matter experts (not mere predictions).

Scenarios can be serve for different purposes: exploration, decision-making, risk assessment, creative thinking, and many others...

Regardless of how scenarios are developed, they must be effectively communicated. The status quo is to use textual descriptions.

Aim of the work

Developing and evaluating different methods for visualizing future scenarios.
1. Using AI to generate Photographs, Comic Strips and Videos from a text
2. Involving experts in evaluation through an AHP experiment

- Diversifying the communication of scenarios
- Enhancing their understanding, retention, and depth of interpretation

Visual outputs may enhance foresight practices by making future scenarios more accessible and engaging to a wider audience.

Starting point

Four experts-based scenarios, obtained from the *'Tomorrow in the Family'* project, conducted to construct future scenarios on the family in Northeastern Italy, over a 10-year horizon.

(Bolzan 2018)

From the items of each scenario, an AI (Adobe Firefly) generated the visualization modalities.

- *Time horizon*: 10 years
- *Objective*: define possible dynamics that will effect the family in North-East of Italy in the near future
- *Design*: Delphi-based scenario

Scenarios

I.   Parents and society: even more for the family
II. At home to feel like family
III. There is no family...without the Internet!
IV. Politics and Volunteering meets family

Each composed of several <u>items</u>

- Text-to-image diffusion model that synthesizes high-fidelity images from natural language prompts.
- Each Delphi item was transformed into a **prompt** by preceding it with a generative instruction such as "generate a picture of...".

Comic Strips
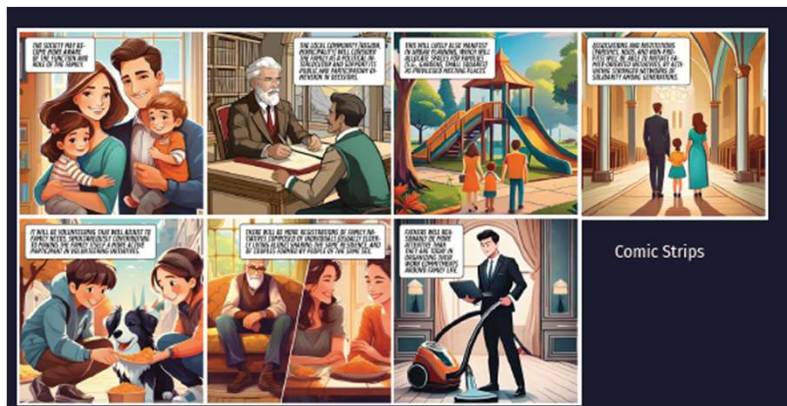
Photographs

3 visualization modalities

Comic strips provide interpretive stimuli through individual illustrations with captions, which can enhance imaginative engagement and abstract reasoning.

Photographs, combined with concise captions, provide immediate visual context and emotional anchoring while preserving a sense of realism and familiarity.

Videos, with their combination of moving images, voice narration, and music, offer a dynamic and immersive modality that can foster a deeper cognitive and emotional impact.

- https://youtu.be/oJPfiMj5910?si=oBZ7__SBgYPYyFYR
- https://youtu.be/Aj29MxXd9vc?si=V221ugiww5hVEzyg
- https://youtu.be/1g7JxeAIe9M?si=Y_oc8VpvSQniViTI
- https://youtu.be/PwYfRxNZOG4?si=oVo-7URsiDJkR8TA

Communication

Online survey via Limesurvey from July 2024 to September 2024 inviting experts from international organizations through a targeted campaign.

Strategy
- Encouraging informed and meaningful engagement with the survey
- Ensuring broad visibility of the research and generating interest in the topic.

Target
- Primary group: experts in Futures Studies
- Secondary group: experts in AI with an interest in the topic.

Channels
- FS Mailing lists: 1,739 subscribers
- FS Newsletters: 4,950 subscribers
- Social Media (institutional): 14,509 followers
- Social media (thematic groups): 22,783 users
- Personal direct invitations to selected experts (44)

  Estimated potential reach of 44,025 experts
  At least 2 reminders per channel

FATHERS WILL REASONABLY BE MORE ATTENTIVE THAN THEY ARE TODAY IN ORGANIZING THEIR WORK COMMITMENTS AROUND FAMILY LIFE.

Survey

First part
- Questions on socio-demographic characteristics (gender, age, country)
- Questions on professional characteristics (professional role, research area, experience with FS/AI)

Second part

Scenarios were assigned randomly based on participants birth month (1 scenario per respondent).

1. Each participant read a text describing the scenario.
2. Then they saw it as comic strips, followed by photos, and lastly as a video.
3. As a final task, each participant was asked to compare the three modalities in pairs (3 comparisons) with respect to 4 criteria (totaling 12 pairwise comparisons).

Approximately 10' to complete

Verbal communication between parents and children will be frequent, and in turn, children will develop satisfying forms of dialogue and relationships with their peers.

Survey

4 criteria

Consistency
The paths to the futures and images within the scenario are consistent with one another (not mutually contradictory or excluding each other in terms of logics or plausibility).

Plausibility
The developments of the scenario are possible; the path to the futures and the images described in the scenario are conceptually feasible.

Clarity
The developments and conceptual futures in the scenario are traceable (detailed enough to be comprehensible).

Simplicity
The developments and conceptual futures in the scenario do not combine too many dimensions and key factors.

The search for solutions in housing design that facilitate encounters among families within the condominium will be particularly relevant and evolving.

- Help section explaining the criteria

Analysis

Analytic Hierarchy Process (AHP) method (Saaty, 1987) supports complex multi-criteria decision making by
- breaking decisions down into criteria and alternatives,
- comparing the criteria in pairs to understand their relative importance.

For each pair of criteria and alternatives, experts were asked which one was more important and by what degree on a scale from 1 to 7.

Table 2. Scale for pairwise comparison

Degree	Definition
1	Equal preference
3	Moderate preference for A with respect B
5	Strong preference for A with respect B
7	Very strong preference for A with respect B

Building strong direct relationships between grandparents and grandchildren, fostering connections within the extended family, won't be easy or guaranteed.

Survey

ILLUSTRATIONS vs VIDEO: For each criterion represented in the rows, we ask you to express your preference in comparing illustrations and video

	Very strong preference for illustrations	Strong preference for illustrations	Moderate preference for illustrations	Equal preference	Moderate preference for video	Strong preference for video	Very strong preference for video
Consistency	○	○	○	○	○	○	○
Plausibility	○	○	○	○	○	○	○
Clarity	○	○	○	○	○	○	○
Simplicity	○	○	○	○	○	○	○

CONSISTENCY vs PLAUSIBILITY: we ask you to determine their importance in the evaluation of the scenario

Very strong importance for consistency	Strong importance for consistency	Moderate importance for consistency	Equal importance	Moderate importance for plausibility	Strong importance for plausibility	Very strong importance for plausibility
○	○	○	○	○	○	○

Results

Respondents Characteristics		n (%)
Gender	Female	77 (42.1%)
	Male	97 (53.0%)
	Other/Not Answer	9 (4.9%)
Age	From 20 to 29	5 (2.73%)
	From 30 to 39	20 (10.93%)
	From 40 to 49	54 (29,51%)
	From 50 to 59	46 (25.14%)
	From 60 to 69	31 (16.94%)
	From 70 to 79	19 (10.38%)
	More than 80	6 (3.27%)
Country	Italy	81 (44.3%)
	Europe	40 (21.9%)
	Central/South America	31 (16.9%)
	Other	31 (16.9%)
TOTAL		**183 (100.0%)**

Variable	Attribute	n (%)
Professional Role	Researcher	86 (47.0%)
	Consultant	58 (31.7%)
	Other	39 (21.3%)
Main Area of Research	Statistics	11 (6.0%)
	Economics	28 (15.3%)
	Social Science	84 (45.9%)
	Communications	36 (19.7%)
	Other	24 (13,1%)
Worked	in FS and with AI	97 (53,0%)
	only in FS	33 (18,0%)
Worked	only with AI	16 (8,7%)
	Neither in FS with AI	37 (20,3%)
TOTAL		183 (100.0%)

Total participants:183

- 44 allocated to Scenario 1
- 47 allocated to Scenario 2,
- 51 allocated to Scenario 3,
- 41 allocated to Scenario 4.

Procedure

01 For each survey participant, an AHP preference matrix is calculated using Saaty's 1 to 7 scale

02 For each matrix, the consistency index and the corresponding consistency ratio are calculated

03 Matrices with a consistency ratio >0.25 (lenient limit) are eliminated

04 The individual matrices are aggregated using the geometric mean

05 The consistency ratio is calculated for the aggregated matrix

06 If the consistency index is less than 0.10 (strongest limit), the principal eigenvector and thus the weights will be computed

Results

The AHP analysis revealed the following ranking of evaluation criteria based on expert judgments:

- Consistency – most important criterion
- Plausibility – second in importance
- Simplicity – third, with a weight close to plausibility
- Clarity – lowest in importance

Criteria (n=14)	Weights
Consistency	0.339
Plausibility	0.295
Simplicity	0.249
Clarity	0.117

Results

Analysis of the comparisons among visualization modalities by criterion:

- Videos demonstrate superior performance across all four criteria in most evaluations.
- This trend is especially evident in Scenario II and Scenario III

Notable exceptions:
- Scenario I: Comic strips appear slightly more consistent than videos.
- Scenario IV: Comic strips are judged clearer and more plausible than the other formats.

Table 3. Weights obtained from the comparisons among the three visualization modalities with respect to the four criteria across the four scenarios considered

		Consistency 0.339	Plausibility 0.295	Clarity 0.117	Simplicity 0.249
Scenario I	Comic strips	0.365	0.299	0.310	0.343
	Photos	0.306	0.303	0.317	0.295
	Videos	0.329	0.398	0.373	0.362
Scenario II	Comic strips	0.324	0.274	0.299	0.322
	Photos	0.292	0.266	0.254	0.291
	Videos	0.384	0.460	0.447	0.386
Scenario III	Comic strips	0.275	0.219	0.194	0.286
	Photos	0.259	0.225	0.252	0.294
	Videos	0.466	0.556	0.554	0.420
Scenario IV	Comic strips	0.340	0.331	0.417	0.347
	Photos	0.316	0.363	0.258	0.286
	Videos	0.344	0.306	0.325	0.367

I. Parents and society: even more for the family
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Results

The results remain consistent in the global weights across the four scenarios:

- Video emerges as the preferred visualization modality, particularly in Scenario II and Scenario III
- Scenarios I and IV show no clear dominance of one modality over the others

Global weights for the three visualization modalities

	Comic strips	Photos	Videos
I scenario (n=44)	0.331	0.304	0.363
II scenario (n=47)	0.304	0.278	0.417
III scenario (n=51)	0.248	0.255	0.496
IV scenario (n=41)	0.350	0.315	0.334

Key insights

- Videos are overall preferred, especially in scenarios II and III

- Comic strips demonstrate strengths over photographs depending on the specific scenario content

- Preference for videos varies across scenarios - the effectiveness of each modality may depend on scenario characteristics and contents

- Including textual-only representations could add value, but would increase complexity

- Using AI for visual generation may enhance transparency in the scenario visualization process - but how transparent is the AI algorithm itself?

Next steps?

❑ Extend comparisons to include text-only scenario representations alongside visual modalities

❑ Explore hybrid formats combining text, images, comics, and video to enhance comprehensibility, memorability, and interpretive richness; consider future use of VR/AR.

❑ Assess the role of scenario content type (e.g., abstract vs. narrative) in shaping modality preferences more systematically

❑ Expand sample size and diversity to validate findings across broader populations and disciplines

❑ Different type of AI for generating visualizations may be explored as well…

Family care needs (for children and the elderly) will be met through collaborative initiatives among families in the same neighborhood/condominium.

Thank you

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