THE SHAPE OF THINGS TO COME: SCENARIOS AND VISUAL STORIES FOR TELECOMMUNICATION IN 2020

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ABSTRACT

The road ahead towards ubiquitous information and communication is not a deterministic path, rather radical alternatives are possible and viable within the upcoming decade. In order to systematically explore alternative future developments in telecommunication and human-computer interaction we investigated futures research reports and trend projections, interviewed experts and conducted a series of workshops with corporate and domain experts. Four scenarios named End of Growth, Postmaterial Lifestyle, Technocratic Corporatism and Bright Digital Future, have been derived. They differ regarding their degree of user impact and technological progress. With a new matching-based approach, nine strategic topics (like machine-to-machine communication and sustainability) have been derived out of these scenarios. Finally the potential of different formats of illustration and animation to advance and communicate futures research results is elaborated upon.

KEYWORDS

Learning Organization, Telecommunication, Strategy, Scenario Planning, Futures Research, Visual Storytelling

1. INTRODUCTION

IT and telecommunications are considered the most innovative and dynamic industries of our times. Over the last 20 years they heavily impacted all aspects of life. Information technologies have developed from a workout exercise for geeks to a multi-trillion dollar business, while the telecommunication industry (telco) has developed from a governmental regime towards worldwide revenues of 3.7 trillion (10^{12}) dollars in 2009 (WTIR 2010). In some cases technological breakthrough has been exploited in order to substitute old, and to generate new business. In other cases advances in usability or user participation have driven these changes with impact on all aspects of modern culture including the ways that business is run today. Still, just like human beings the industry needs to look ahead to not be dead tomorrow. Strategic orientation is needed to inform the allocation of resources and the perception and rejection of opportunities. What measures should IT and telecommunication companies take today in order to prepare for an uncertain future, what search fields should they invest in or at least investigate in more depth?

What if? What if, in contrast to the conventional projection, the current exponential growth in processing power, connectivity and online collaboration is followed by a long period of stagnation, or what if increasing computational power and positive feedback accelerating technological progress lead to the emergence of a new singularity (Kurzweil 2005) surpassing human intelligence and taking control of its own actions? Phenomena like exponential growth overstrain our imagination; and in some cases only hindsight bias (the retrospective attribution of predictability to once-future events) provides for a sense of control and of sufficiently informed future orientation.

Insufficient information and reflection upon potential future developments yields fundamental threats to organizations working with mid- and long-term investments. Like other high investment infrastructure companies, telecommunication providers work on five to ten years plans in major parts of their business. Long investment life cycles (10 years and more for infrastructures, 1-5 years for services) for high volume investments into durable infrastructures like cables, satellites and the energy provision to run them pair up with market driving power even within related service fields. Being well prepared for mid-term future developments is of existential importance for all actors in this industry.

In spite of this importance the telecom industry's track record in predicting future needs is poor. The next big thing was regularly out of sight – not only regarding technological topics (like ATM, ISDN, 3G), but especially for usability and user-driven developments like the World Wide Web, SMS, and Web 2.0. Oftentimes predated mindsets persist and limit future imagination. Tunnels of imagination may then turn out as bottlenecks for innovation. In order to face these threat, to cultivate a sense for potentials within the organization and to inform future oriented research and development we set up a futures research project.

Implicit assumptions about the global future landscape of HCI research and development impact local decisions today. Still, lacking empirical evidence and scientific rigor most authors refrain from futures speculation. Thus, strategic knowledge of orientation remains implicit or missing. Our contribution combines an approach to generate and communicate strategic insight on future developments with exemplary results as a basis for discussion and setting priorities within the development of HCI today. On the one hand this paper focuses on scenarios for 2020 and their impact on managing innovation in the IT and telecommunication industry. On the other hand it focuses on different approaches to (visual) storytelling, sketching, illustration and animation as means to advance and communicate futures scenarios.

2. RELATED WORKS (FUTURES RESEARCH AND SCENARIOS)

Futures research as scientific study of possible, desirable and likely future developments (Kreibich 2000, 9) assumes that different, but not arbitrary or countless futures are possible and viable. Its interdisciplinary and multidisciplinary research approach matches potential futures that also develop across disciplines. As the Greek politician Pericles mentioned in the 4th century B.C. the task is not to predict the future, but to be well prepared for it. Accordingly scenario planning emphasizes decision-making utility as main outcome of inquiry over the production of testable knowledge (Walton 2008).

While futures studies may rarely apply controlled, repeatable and falsifiable experiments with highly standardized methodologies, still, scientific principles apply. Their statements must be plausible and checkable (Opaschowski 2008), being based on transparent, traceable reasoning, and theoretically based methods instead of esoteric insights and beliefs. Recombining knowledge from various disciplines its methodological approach reaches beyond analytical and descriptive paradigms of traditional science to include communicative and participatory accounts (Kreibich 2010). Apart from the differing scenarios as such this paper therefore addresses the communicative visualization and advancement of the results.

Scenarios enable us to anticipate and structure discussion about the shape of things to come. Within the broad field of futures studies scenario analysis and planning represents a privileged methodology (Ramirez, Selsky, & van der Heijden 2010; Ringland 1998). Since the Royal Shell Dutch Group conducted the first systematic scenario studies in the 1970s based on the work of Kahn & Wiener (1967) numerous scenario-processes have been conducted and their results published (e.g. Ducatel et al. 2001; Schoemaker 1995). While the Shell approach gained impetus with the Oil Shock in 1973, dynamic developments in the IT and telecommunications industries and its environments suggest that scenarios are a valuable approach to address and prepare for upcoming uncertainties.

Thinking in alternative futures prepares and informs decisions how to strengthen desirable developments. Scenarios point out alternative and logical consistent development possibilities in the face of abounding uncertainties. Unlike traditional forecasting and even recent Delphi Studies (Münchner Kreis et al. 2009) scenarios do not intend to predict the future. Instead they fuel strategic conversation (Van der Heijden 2005) and challenge conventional assumptions. They prevent from linear extrapolation, and foster thinking in alternatives. Peter Schwartz, one of the founders of this approach, writes: "Scenarios are not predictions. It is simply not possible to predict the future with certainty… Rather, scenarios are vehicles for helping people learn" (1991; also see Schwartz 2009). Other than simulations they identify patterns and clusters among possible futures and include subjective interpretations (Schoemaker 1995, 27). Scenario planning then aims at changing mindsets about external factors antecedent to the formulation of specific strategies.

Principles and best practices of scenario planning have been described in (van der Merwe 2008). In order to identify the most relevant influencing factors and future possibilities an explorative approach was chosen over a normative approach focusing only on the most desirable outcomes (Gaßner & Kosow 2010). The basic methodology of the scenario approach we followed has been described e.g. in Fink, Schalke & Siebe 2000 or Fink & Siebe 2006.

3. METHODOLOGICAL APPROACH

"A constant stream of rich, diverse and thought provoking information" (Schwartz 1991) was needed to feed organizational learning we intended. More than 200 publications have been reviewed and extracted, corporate stakeholders and focus topic domain experts were interviewed, and a series of three workshops has been conducted. All intermediary results have been aggregated and refined within a core team of 4 researchers. Various approaches to advance and communicate results have been explored. The goal was to:

- Identify alternative developments and potential impact in the most vibrant technological focus fields
- Develop consistent and historically plausible future scenarios for the year 2020.

Scenarios describe plausible visions of the future and consist of multiple dimensions (Fink et al. 2000). The dimensions consist of a number of influence areas and relevant trends. In order to identify an undefined number of distinct scenarios we took four steps:

1. System analysis and detection of key factors: System levels and influence areas are developed, influence factors are described, and key factors for future developments are identified.
2. Description of alternative future projections: Future projections are formulated on basis of the key factors, these future projections are development alternatives of the single key factors.
3. Combination of future projections to scenario creation: A manageable number of three to six alternative pictures of the future are developed. They form the basis for the future scenarios.
4. Analysis of the scenarios and their interaction: Scenarios are refined and strategically interpreted; results are condensed and later on used for strategic planning.

Within the first step the subject area is structured into system levels & influence areas with a focus on technology & user respectively human. On the human side we differed between an individual, an interpersonal and a social level looking into attitudes and values, behavior and preferences, social relations and allocation (social structure). On the technology side we started with five areas of vivid research and innovation like usability and security. The specific environment of European telecommunication is dominated by legal frameworks and issues of regulation. Adapting the PESTEC framework (representing Political, Economic, Social, Technical, Ecological and Consumer; Runonen & Mannonen 2009) the global environment was defined to include economy, politics, society, and ecology.

Focusing on the technology and customer side a three months literature review was conducted in order to identify trends and influencing factors within these domains. Besides internal resources for corporate foresight like Customer Foresight and Technology Radar (with reports from an international network of technology scouts; Thom & Rohrbeck 2009) major publications of academic societies like IEEE and ACM have been reviewed. Interviews with 18 experts from research and development in engineering, innovation marketing, and strategic management yielded additional information on potential factors that impact telecommunication within the next ten years. Broadly following a "grounded innovation approach" (Breuer & Steinhoff 2010), 89 factors (e.g. standardization and ubiquitous computing) have been identified and described with evidence from the literature review and interviews.

An influence matrix reveals factors whose development has high impact on the whole system. A core team of five experts from innovation marketing, strategic management and engineering was asked if e.g. developments in standardization impact developments in ubiquitous computing in terms of: "no influence", "weak / delayed influence", "regular influence", or "strong / immediate influence". The team discussed the influence of each factor on another factor in the system and assigned ratings between 0-3 accordingly. Within the resulting influence matrix the sum of a row indicates the influence a factor has on the system (active sum), the sum of a column indicates how much a factor is influenced by the system (passive sum). A combination of both variables indicated the most dynamic key factors being highly influential and subject to other factors at the same time. For each of the 9 resulting key factors we identified the two main uncertainties associated with each factor and mounted possible developments along these dimensions resulting in two decisive dimensions spanning up a matrix of four alternative scenarios.

One factor for example was convergence. On a vertical axis we differentiated between high and low convergence of content and services (vertical integration). On a horizontal axis low versus high technical convergence of systems (channels, networks, devices / horizontal integration) were distinguished. Four alternative projections resulted (i.e. all in all low level of convergence, high level of horizontal integration, high level of vertical integration, high levels of vertical and horizontal convergence).

The third step started with these 9 key factors and 4 projections for each. A consistency check (matrix) was applied to sort out combinations that are unlikely to occur simultaneously in the future. For each of the 576 potential combinations of projections a consistency value between 1 and 5 was assigned to identify the most consistent combinations. Finally a cluster analysis was performed on the most consistent combinations – grouping combinations with high similarity. As a result, four alternative and consistent sets of projections were identified. These alternative "pictures" of the future span the range of possible developments. Each cluster is interpreted as one future scenario. For each of them we elaborated:

- Names (e.g. "bright digital future"), essential characteristics, driving and reactive forces, winners & losers within the particular scenario, customer needs and technologies,
- opportunities (e.g. dominant players to enter adjacent markets) and threats (e.g. new competitors),
- indicators (e.g. further increase in technical performance and customer demand for high class ICT),
- measures to be taken for each scenario (e.g. opening toward customers and fulfillment partners with flexible supply chain networks and advanced open innovation, fostering a culture thriving openness, creativity, flexibility and customer value orientation).

4. THE SCENARIO SPACE

The four scenarios can be distinguished according to two major development paths: the "technological process" and the "impact of the customer". The axis "technological process" describes the ongoing increase of computation power, bandwidth, miniaturization, etc. and its extremes can be characterized by the end of "Moore's Law" (Terman and Lanzerotti 2006) and "Gilder's Law" (Gilder 2000) or the ongoing predominance of these laws (According to Moore's Law transistors placed on an integrated circuit are doubling every 18 months while prices are falling. According to Gilder's Law bandwidth triples every 12 months). The axis "impact of the customer" describes the involvement and the integration of the customer in upcoming developments. Figure 1 illustrates the two axes with its four scenarios.
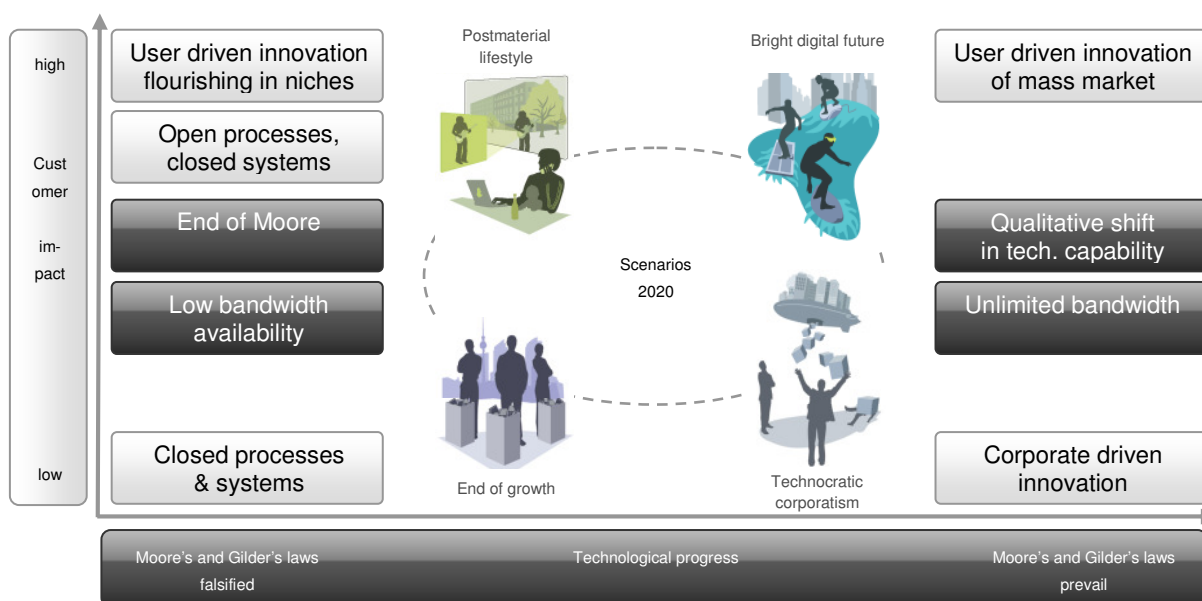

Figure 1. Two forces with major impact on the telco industry: "technological progress" and "customer impact".

The four scenarios span the space of relevant possibilities that ICT players should prepare for. According to the digital value chain, each may be described with respect to the dominating content, available infrastructure, offered services and widely-used devices. For the digital future scenario this could be specified in terms of personalized rich media, user generated content, infrastructure with LTE-A (long term evolution advanced) and more than 100 Mbit/s, FTTH (Fiber to the home) with >200 Mbit/s, and a unique service-

oriented architecture, Including network centric storage, identity-management, and open innovation of context aware services, and Interoperable high-end mobile devices including autonomous robots.

5. FROM SCENARIOS TO TOPICS

The four scenarios roughly describe the space that telecommunication companies should prepare for within the next ten years. These scenarios help to get a better understanding of the future, but on this high level of aggregation they don't prescribe the most relevant topics for the telco industry. To obtain such a set of most relevant "telco topics", we developed a three step approach:

1. Review and aggregation of the 89 factors and contributing information sources initially used to describe and specify the system image into topic fields. Information from internal and external researchers, customer foresight and our internal tool for technology forecasts called "technology radar" (Technology Radar 2009) was leveraged for this purpose. Missing pieces of information were investigated in an iterative fashion (see Breuer & Steinhoff 2010).
2. Filter the topics and topic fields according to three criteria (1) "big" - the topic must lead to a paradigm shift or disruptive change, (2) "new" - it must imply a new insight and (3) "impact" – the topic must have an impact on the telco. As a result, an unordered set of topic fields was derived.
3. Map this set of topics onto the scenarios and judge the impact of each field in the underlying scenario by a team of experts.

Finally trends with major impact in one or more scenarios were selected, e.g. advanced M2M communication for the Digital Futures and Technocratic Corporatism, and Sustainability as a characteristic of the Postmaterial Lifestyle:

- M2M-Communication: Ever more objects – machines, household devices and vehicles – come equipped with ICT components and communicate via the Internet. The increasing connectivity of devices enables new services, but also creates new requirements for telecommunication enterprises.
- Sustainability: Responsible management of our resources is essential to secure our future. "Going Green" is not enough – sustainable solutions are required which not only delay the exhaustion of resources but stop it through a paradigm shift including regulatory and behavioral aspects.

6. DEEP DIVING AND VISUAL STORYTELLING

The nine topic fields have been investigated in more depth. Simultaneously suitable media for communication of research results have been explored and in some case the materiality of these media as well as preliminary sketches provided valuable means to advance the subject. Detailing a realistic narrative for instance usually directs attention to aspects that would have else wise been overlooked (Schoemaker 1995, 26). In particular a newspaper with animated images, illustrated deep dives into topics and an animation movie were developed in order to communicate the results in tangible ways.

- An introductory presentation describes the initial motivations for the project, its methodological approach, and the resulting scenarios.
- An animated newspaper exemplifies consequences of consequences of the developments in terms of technological and societal change.
- Deep dives into nine topics describe a reasonable trajectory from observable facts to a potential future within one field of development.
- Finally, an animated movie synthesizes selected aspects of these developments involving advanced animation and artistic irritation.

Thinking through consequences of consequences within the scenarios and focus topics an animated newspaper of March 17th 2020 has been created. The format was chosen to enhance suspense, to present a variety of appealing stories and distribute it not only on paper, but also on ebooks and other mobile devices. Figure 2 shows the chosen illustration – by selecting an image, the related story appears with animated images. Two examples:

- Twin Stalker Law Passed: Berlin – Since DDT (Digital Twin Trauma) was added to the ICD 12 classification of diseases two years ago, more than 1 million cases have been diagnosed worldwide, leading to overcrowding of mental patient hotels. Victim Tomas D. complains: "My devices are stalking me – I can never relax or sleep. The vacuum cleaner announces sales, the cleaning robot obstacles, the toaster cries for full-grain input. Can't they just leave me alone?" The Twin Stalker Law will protect humans and their digital twins from obtrusive agents. Privacy and stalking laws are now being applied to smart devices. Deviant programs, devices and robots are now blacklisted at the Federal Systems Control.
- Jan Hog is Eco Star 2020: Cologne – With the lowest, in fact a negative, carbon footprint Jan Hog has beaten all other participants in the popular show „Germany's Next Eco Star". His mobile Carbon Calculator showed an astonishing 200KWh, which he has created and uploaded to the power grid at his favourite hotspot over the past 6 months. The New Times has interviewed him on his amazing plus-energy house, new stylish hybrid vehicles, and on his daily „maximum energy upload exercise routine.

Diving deeper into technology-related topics, for each of the nine selected topic a detailed story has been developed. Like future scenarios they describe a reasonable trajectory from observable facts to a potential future within one field of development in a tangible form of narration. Finally, a comic – serving as a teaser – was created. This animated movie (figure 3) synthesizes selected aspects of these developments involving advanced animation and artistic irritation.

Figures 2 & 3. An animated newspaper (illustrated by Gabriele Heinzel), and an animation film created by S. Weikopf (2009), depicting aspects like "smart glasses", "virtual environment", "car-2-car communication" and "mobile payment".

Each illustrative approach has its strengths and weaknesses. The newspaper fosters futures imagination by not only presenting future news but condensed stories of public interest resulting from potential developments. Its strength is triggering controversial discussions among technical laymen, but it is limited by its focus on single influencing factors. The deep dive stories provide for a more comprehensive understanding of a topic and several contributing factors. Not only as if stories, but also interacting factors and systems may be visualized. As stories written from a future point of view they come closest to the original scenarios written by Hermann Kahn. Providing a more complex, almost scientific sounding, but still graspable image of the future and back-casting current developments that led to it they suit for researchers and developers. The animation is most advanced in terms of an interpretable storyline, visualization and specification since use cases are actually shown at work within hypothetical future situations. They are best suited to gather attention and initiate discussion but do not qualify well as shared reference for critical discussion and strategic planning. The most comprehensive communication format for this purpose is the detailed presentation that is available upon request.

In the early days of scenario Kahn and colleagues describes scenarios as stories as if written by people in the future. Other formats of (visual) storytelling have been tried out since, but only rarely been documented. Alternative visualizations that have been documented include for instance a world map of islands – each representing one scenario, or caricature of succinct features of the scenarios (see Fink & Siebe 2006). Still, even though several authors have stressed the importance of suitable ways of communicating scenarios,

potentials, strengths and weaknesses of each (visual) approach have never been explored in a systematic way. Such research would need to focus on the different communicative purposes of scenarios (e.g. to initiate public discussion, trigger organizational learning or inform strategic decisions). It would continue works on instructional media (Niegemann et. Al 2008, 207ff; on images Weidenmann 1994), but refocus on animating "as-if" worlds of the future.

7. SUMMARY AND OUTLOOK

For organizational strategy and development the scenario process and its results are capable of several contributions:

- Learning organization: An alternative way of informing experts and employees about innovative technologies and initiating related discussions.
- Challenging given assumptions, new roadmaps of potential development appear. They disclose search fields and opportunities for new business that otherwise might have been neglected.
- The scenarios create a contrasting background for the interpretation of upcoming topics and help to inform strategic decisions.
- Concrete, robust measures may be derived that ensure sustainable growth considering different scenarios at the same time.

In our project, main attention has been paid on the identification of critical topics and on suitable formats for communicating these topics. For developing future scenarios well proven methodologies exist. However, the way from scenarios to strategic topics is still beyond state of the art. Therefore, a new matching approach was developed in which a set of trends is projected into the scenarios and as a result a set of most imported topics is derived.

Advanced communication channels (animated illustrations, movies, storytelling, etc.) have been set up. However, we observed that suitable feedback channels interwoven with the topics and their presentations are still missing. New channels for rich feedback applying e.g. blogs or tweets might enrich communication and the organizational learning intended around the scenarios.

The practical use of scenarios largely depends on the decision making processes following the scenarios. It usually involves strategic planning and budgeting, and setting up suitable monitoring systems (Schoemaker & Gunther 2002). In our particular case, situated in research and development the scenarios outlined above were loosely coupled with top management decisions, but still inform the research and development agenda.

Six of the nine trends could be directly correlated with running research and development (R&D) projects at our laboratory. They are serving as a source for inspiration and are used by the associated R&D teams as a communication tool for motivating their current R&D activities. The "sustainability"-issue was not yet sufficiently covered by ongoing R&D projects – therefore, this trend was used for initiating further R&D activities concerning "sustainability" (see Forum for the Future 2010). Generic trends like "digitization" (of everything that can be digitized) also affect a large set of our R&D projects and indicate the global change in the telecommunication industry. Therefore, they were mainly used for discussion with top-management and build the starting point of several workshops concerning technology strategy.

Since only few systematic applications of scenario processes in organizations have been reported, and given the long timescales being addressed, proving the value contribution of scenarios remains a great challenge. Additional scientific research on the benefit of scenarios (see Schoemaker, 1993), their comparative performance and different formats of visual storytelling and communication is needed. Here the decisive benchmark is not predictive validity, but the contribution of the approach to organizational learning and preparedness for dealing with uncertainty. Essential is an understanding that scenarios may not dissolve uncertainty but should help to get used to it and to prepare decision makers for a variety of developments, even beyond the manageable set of scenarios that may be anticipated.

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