Origins of information visualization in corporate bullet points: an archaeology of the graphic configuration paradigm in data visualizations (1979–1995)

Origens da visualização de informações em tópicos corporativos: uma arqueologia do paradigma de configuração gráfica em visualizações de dados (1979–1995)

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data visualization, dataviz, charts, presentations, slides

The present work seeks to highlight the origin of the current paradigm of data visualization design and the logic of creating charts and presentations, which emerged with the personal computer revolution. The initial digital tools developed for producing corporate communication artifacts were crucial in establishing the reasoning and production flow of visualizations up to the present day. Knowing beforehand that the origin of data visualization predates personal computing by centuries, it's surprising that it is now entirely subject to models and guidelines originating from computer sciences. Through an investigation conducted with an archaeological method adapted to design artifacts, it is possible to understand the discontinuity and abrupt transformations experienced in the conventions and values of this practice. Through this methodological approach, along with the analysis of the productive mindset discourse and the available tools in this specific period, it becomes possible to explain the changes that aparted the craft of visualization artifacts from the domain of art and/or design, subjecting them to corporate sphere empowered by emerging arsenal of information technologies.

visualização de dados, dataviz, gráficos, apresentação de dados, slides

O presente trabalho busca evidenciar a origem do atual paradigma de configuração dos artefatos de visualização e da lógica de elaboração de gráficos (charts) e apresentações (slides) que surgiram com a revolução da computação pessoal. As primeiras ferramentas digitais desenvolvidas para a produção destes objetos da comunicação corporativa foram decisivas para o estabelecimento do raciocínio e fluxo de produção das visualizações até os dias atuais. Sabendo de antemão que a origem da visualização de dados é secularmente anterior à computação pessoal, parece estranho que ela se encontre hoje inteiramente sujeita a modelos e norteadores oriundos da computação. Através de uma investigação realizada com método arqueológico adaptado aos artefatos de design, é possível compreender a descontinuidade e as transformações abruptas ocorridas nas convenções e valores desta prática. Através deste dispositivo metodológico, com a análise do discurso produtivo e das ferramentas disponíveis neste período específico, torna-se possível explicar as mudanças que retiraram a confecção dos artefatos de visualização de um domínio da arte e/ou do design, sujeitados então à esfera corporativa potencializada pelo arsenal nascente das tecnologias da informação.

1 Introduction

Data visualization is a highly specialized typology of graphical artifacts. Two diagrams are recurrent examples in the field (Cairo, 2019; Tufte, 1985), attempting to delineate a beginning for the practice commonly referred as data visualization: the map elaborated in 1854 by the English physician John Snow, containing each case of cholera in the Soho district of London, and the polar area diagram containing the causes of mortality in the British army during the Crimean War, elaborated in 1856 by the founder of modern nursing, the statistician Florence Nightingale. Another precursor that we could include in this list was the engineer William Playfair, who published several graphs in 1786 in his Commercial and Political Atlas.

During the period in which these artifacts were elaborated, what we contemporarily call Design had not yet been formally instituted, whose canonical temporal landmark is often considered the short period of operation of the Bauhaus school in Germany, from 1919 to 1933. All activity regarding the configuration of graphical artifacts before this moment, when the conception of Design as a formal profession had not yet been

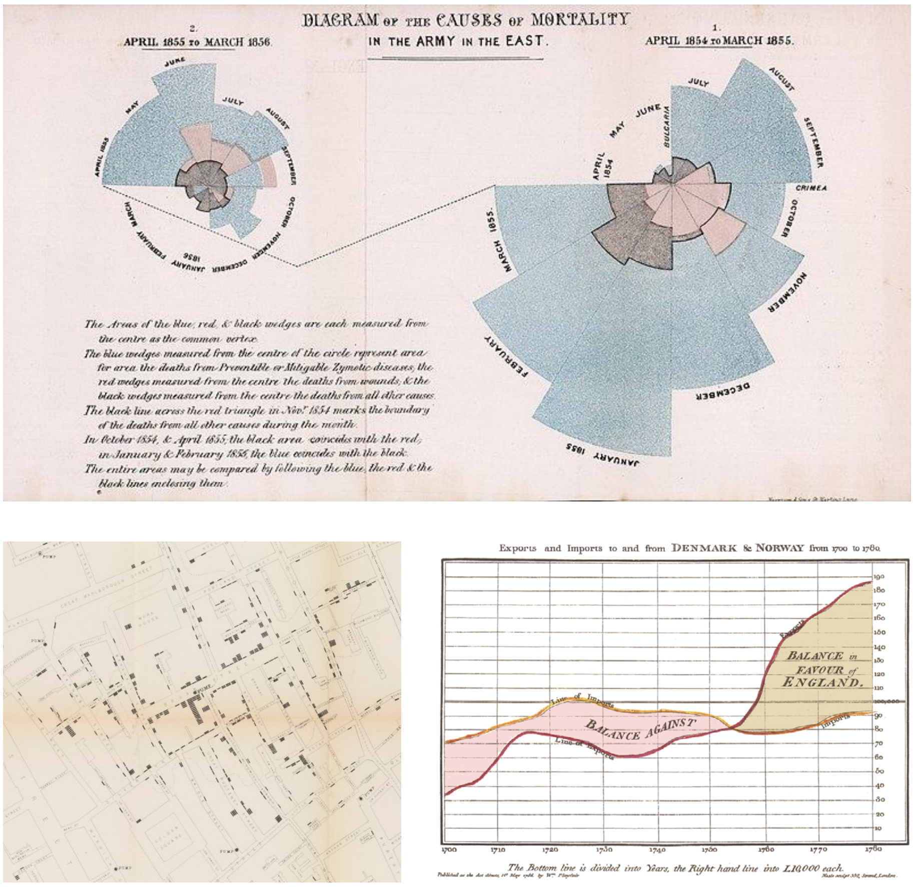

Figure 1 Florence Nightingale's Polar Diagram (top), details of John Snow's map (bottom left), and William Playfair's trade balance chart (bottom right). Source: mapping of historical visualization artifacts from Laboratório de Visualização e Sentidos.[1]

1 https://visse.vercel.app/mapeamentoartefatos/?filtra=hist%C3%B3rico

instituted, establishes itself in an ambiguous condition: the concept of designing artifacts evidently was already present, but it was executed by a varied range of professionals with very different perspectives, such as commercial artists, craftsmen, and, as evidenced by the aforementioned artifacts, health professionals.

The purpose of this contextualization is not, by any means, to question the origins of Design, but rather those of data visualization; by taking the examples presented as pioneers, it would be possible to assert that their origin and paradigms belong to the health sciences at this time.

A few decades later, between 1890 and 1900, sociologist and activist William Edward Burghardt (W.E.B.) du Bois produced a set of historically significant visualizations elucidating racism and segregation against the African American population in the United States following slavery abolition. Du Bois's pieces are visually distinct from those created by Snow and Nightingale, crafted with a graphical configuration closer to artistic expressions, adopting visual elements of free and playful forms, without significant verbal supplements.

Considering these three initial historical sets, it does not seem plausible to establish an ontology for visualization artifacts as a practice belonging to any of the mentioned fields, or any other for that matter, nor to consider it as the product of organized and structured knowledge; visualization, in its earliest origin, occurred through the isolated and disjointed action of some professionals who adopted it as a strategy to communicate something meaningful, without any trace of prior experiences or indications on how to do so.

Throughout most of the 20th century, the development of these graphical elements was relegated to cartographers and statisticians, attracting little interest from designers that work with graphical artifacts, the notable

Figure 2 Visualizations by W.E.B. du Bois. Source: mapping of historical visualization artifacts from Laboratório de Visualização e Sentido.[2]

2 https://visse.vercel.app/mapeamentoartefatos/?filtra=hist%C3%B3rico

exception is the work led by Otto Neurath: ISOTYPE. Although ISOTYPE is found in publications featuring graphs, diagrams, and maps, it is difficult to categorize Neurath's Isotype system solely as data visualization, as its purpose was to create a system of universal signs and transform information into something more easily understandable by anyone. However, the influence of ISOTYPE on contemporary data visualization is significant, as noted by Cunha Lima (2008). This influence extends from methodological practices to sophisticated use of pictorial language. For Twyman (1975), Neurath "saw the need to establish a set of conventions in order to make communication easier and more effective" (Twyman, 1975, p. 10). In a brief analysis, considering the graphic language vocabulary of Twyman (2004; 1982; 1979), we can identify syntactic principles and semantic strategies highly pertinent to data visualization. Furthermore, within the ISOTYPE team, the division of labor placed the transformer in a pivotal position. According to Burke et al. (2013), this figure serves as an antecedent to the contemporary information designer. Acting as an intermediary, the transformer serves as an intermediary between the scholars responsible for data collection and the graphic artists tasked with representing that data visually. Despite these significant contributions, ISOTYPE appears undervalued as a pioneer in visualization, largely due to its emphasis on pictorial aspects.

Charts and statistics were frequently used in media communication (newspapers, magazines, and later on TV), but often used in questionable ways. This is evident from Edward Tufte's justification for writing his seminal book "The Visual Display of Quantitative Information" (1983): Tufte dedicated himself, in the late 1970s and early 1980s, to criticize and

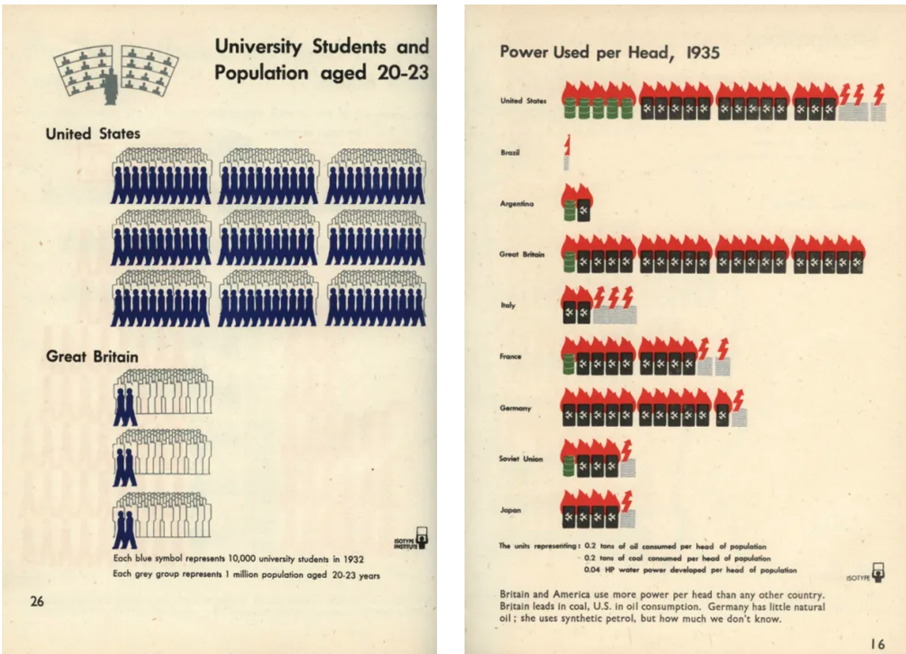

Figure 3 Information representations using the Isotype system. Source: mapping of historical visualization artifacts from Laboratório de Visualização e Sentido.[3]

3 https://visse.vercel.app/mapeamentoartefatos/?filtra=hist%C3%B3rico

teach how to develop appropriate data representations, something he described as a challenging exercise for these professionals, as they lacked solid statistical foundations in their training.

The late 1970s and early 1980s were a vibrant period for data visualization, not only due to the development of seminal bibliographic works (such as Tufte's) that paved the way for knowledge on the subject, but also due to the availability of new automated methods for their production. Until then, building charts was a laborious manual task that required a deep understanding of geometry (to ensure that the visual expressions faithfully respected the appropriate statistical proportions) and technical skill to cut and paste the constituent graphical elements throughout the material produced, precisely and neatly. In addition to the manual difficulties involved, "last-minute changes" to the represented data were not uncommon, requiring the complete reconstruction of artifacts in even less time than originally available.

The use of charts in publications, news articles, or organizational reports brought production difficulties and consumed a considerable amount of time; therefore, their use could not be incorporated into a graphic project without deep concerns or just for decorative purposes. They were rather special elements within communication projects, across all media.

1.1 The home computer era

The personal (and global) computing revolution brought new means for the production of this type of artifact. Although understood as the emergence of "home" devices, the concrete transformation it brought about was the democratization of computing, making computer equipment accessible both to households and, to some extent, to businesses and organizations. A computer such as the Xerox Star 8010 Information System, a workstation developed in Xerox labs since 1972 under the original name Alto but marketed as a personal computer from 1981 onwards, cost around US$ 100000.00[4] in its complete configuration, which represents approximately 300 to 400 thousand dollars in 2024. Even under these conditions, the product's advertising depicted it surrounded by children in a home environment, as if it were intended for everyday use by the family, much like we understand the use of a personal computer today.

By the late 1970s, personal computers released by Apple and Atari cost US$ 1298.00[5] and US$ 1000.00[6] respectively, while an IBM-PC 5150, geared more towards professional activities rather than domestic use, cost US$ 1565.00.[7] These were considered high values in a segment of generic electronic equipment (around 3 to 4 times these values considering currency depreciation until 2024), but they have remained at similar levels until today as a reasonable range for personal computing. Under these conditions, computerization of small businesses became feasible, along with the possibility of computerizing the work performed by an entire larger organization through the acquisition of various equipment much more accessible than a Star, for instance.

4 Source: https://en.wikipedia.org/wiki/Xerox_Alto

5 Source: https://en.wikipedia.org/wiki/Apple_II

6 Source: https://en.wikipedia.org/wiki/Atari_8-bit_family

7 Source: https://en.wikipedia.org/wiki/IBM_Personal_Computer

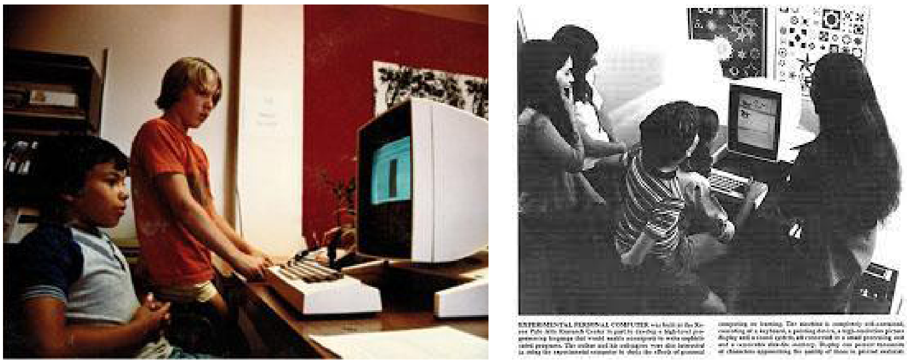

Figure 4 Images used for the promotion of the Xerox Star 8010 Information System throughout the 1980s. Source: Authors' collection.

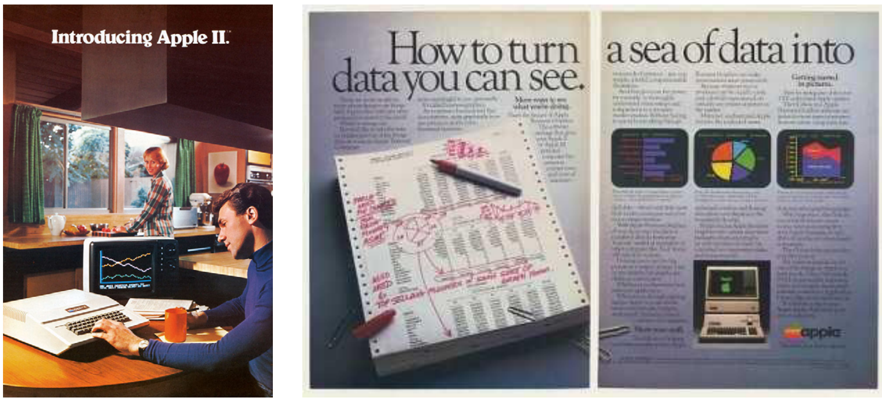

Figure 5 Images used in the advertising of Apple computers, emphasizing their capacity for chart creation as the main selling point. Source: Authors' collection.

In developed countries, the adoption of digital production tools in work activities began in the 1980s itself. The present study focused on analyzing the set of tools used during this period for chart construction, which delineated what was treated as data visualization at the time, as well as the spreadsheet software used for data processing, and the slide tools used for presentations. These were not products restricted to the business segment but had no penetration, use, or relevance in other contexts, such as the educational environment (elementary, middle, or high school); today, we can envision that they would make some sense for higher education, but this only materialized more than 10 years later.

We developed this study from the perspective of production tools, which, subsequent to the computerization of the sector, conform as softwares. The view on those types of instruments are often depreciated, as if they were minor parts in the design process, which would occur with or without them. However, production and manufacturing tools are fundamental elements of design activity and the configuration of any artifact; what they enable to be built, produced, or manufactured, returns to the intellectual processes of elaboration/configuration as viable possibilities, and consequently, part of what is projectable (or "how to design"). In this sense, the famous

Culkin's sentence about McLuhan's work, "men shape tools and then tools shape men" (Culkin, 1967, p. 50), seems appropriate to think about the possibilities of Design, and studying them is also understanding why designed artifacts acquire certain contours or configurations. Tools are not determinative, since with infinite resources and efforts, it will always be possible to do what they don't accommodate as a possibility. But solutions and configurations that go beyond what the available instruments can easily provide are typically considered unfeasible or unsustainable. A real industry does not operate with production on a scale in a craft-like manner or with mechanisms that are difficult to replicate or reproduce. It is precisely under these conditions that tools shape the configuration of a project even in its intellectual aspect: leading its designer to opt for solutions whose fabrication finds smoother means of execution. In other terms, it is to recognize that the practice of Design is never alienated from the production process employed for the manufacture/construction of the artifact in question.

Lev Manovich (2013), a renowned researcher in the field of computational media, reinforces the relevance of studying these tools:

> What is software studies? Here are a few definitions. The first comes from my The Language of New Media, where, as far as I know, the terms "software studies" and "software theory" appeared for the first time. I wrote, "New media calls for a new stage in media theory whose beginnings can be traced back to the revolutionary works of Robert Innis and Marshall McLuhan of the 1950s. To understand the logic of new media we need to turn to computer science. It is there that we may expect to find the new terms, categories, and operations that characterize media that became programmable. From media studies, we move to something which can be called software studies; from media theory – to software theory. Reading this statement today, I feel some adjustments are in order. It positions computer science as a kind of absolute truth, a given which can explain to us how culture works in software society. But computer science is itself part of culture. Therefore, I think that Software Studies has to investigate the role of software in contemporary culture, and the cultural and social forces that are shaping the development of software itself. [...] if we want to understand contemporary techniques of control, communication, representation, simulation, analysis, decision-making, memory, vision, writing, and interaction, our analysis cannot be complete until we consider this software layer. Which means that all disciplines which deal with contemporary society and culture – architecture, design, art criticism, sociology, political science, art history, media studies, science and technology studies, and all others – need to account for the role of software and its effects in whatever subjects they investigate (Manovich, 2013, p. 10).

In his advocacy for the shift from media studies/theory to software studies/theory, the author references a seminal work in computer science, "Tools for Thought", by Howard Rheingold, which precisely proposes this new programmable, algorithmic, or computational media as a tool that enhances our cognitive abilities and is intended to assist us in the intellectual issues present in the problems we deal with (Rheingold, 2000). Manovich emphasizes the implicit rupture in Rheingold's argument that "software is not just 'technology', but rather a new medium" (Manovich, 2013, p. 12).

The revision of his initial proposition about these studies as a domain of computer science is necessary and allows him to understand that software and computerized production tools are part of how we do things, a principle by which anthropologist Roy Wagner defines the concept of culture: "the sum of our ways of doing things, the sum of 'knowledge' as we know it" (Wagner, 2009, p. 80, authors' translation).

2 Procedures

The first phase of the study can be understood as a form of digital archaeology, as if we were excavating ruins in search of forgotten artifacts: an in-depth search was conducted for commercial digital tools available in the segments of spreadsheets, slide editors, and chart builders between 1979 and 1994. These years mark the starting point of the research period with the creation of the first spreadsheet software, VisiCalc (1979), and the endpoint with the release of Microsoft Windows 95 (1995), the first graphical operating system of the Windows family[8] (and not a MS-DOS Shell), whose paradigm of use (or the user) of computing extends from 1995 to the current versions, and can be understood as the same production context, or the same ways of using this media, that we experience today.[9] The study's scope delimits a technological context preceding what we experience in the present, which was much less intuitive and demanded significant effort from individuals to appropriate the tools, largely achieved through extensive training to enable access and full utilization of their benefits.

32 different products were identified, each with numerous versions (version 1, 2, 2.5, etc.) for different platforms (PC/Apple), of which 21 were directly manipulated through a software preservation experiment that allowed this smaller set to run within emulators of computers from that time, with compatible operating systems and execution contexts. 11 of the identified products could not be emulated due to the difficulty of reproducing their original environments and installing them on virtual devices.

These tools were initially observed through images (screenshots) showing their interface and, typically, the available features and results they were capable of producing. Subsequently, the research sought audiovisual materials demonstrating the functioning of the products, usually available through the YouTube website, with demonstrations of tool usage, or training materials from that time made available on it as historical records. Finally, the last stage of observation involved attempting direct manipulation of the tools themselves.

The manipulation of these products provided researchers with a firsthand understanding of how these tools operationalized the production of artifacts, and consequently, the inherent logic of how these artifacts needed to be conceptualized in order to be elaborated within them. In many of the still-existing products, this rationale remains the same up to their current versions, improved in terms of features, usability, ease of construction, speed, and scope (amount of processed data), but essentially operating on the same principles.

8 It may be necessary to clarify that the early products of the Microsoft Windows family, such as Windows 1.0, 2.0, 3.0, 3.11, and Windows for Workgroups, were not operating systems per se, but rather a graphical platform operating on top of the Disk Operating System (MS-DOS).

9 By "current" or "today", it is implicitly understood to refer to the time when the present text was written (2024). Given the rapid pace of technological transformation, or the year in which this text may be read, the "current" paradigm may be different.

Table 1 List of software available between 1979 and 1994, identified by the research as commercial tools for chart production, slide creation, and data visualization.

Software	Year	Type	Manipulated
VisiCalc	1979	Spreadsheet	YES
Microsoft Multiplan	1982	Spreadsheet	YES
Lotus 1-2-3	1983	Spreadsheet + Charts	YES
SuperCalc	1983	Spreadsheet	NO
VisiCorp VisiOn	1983	Integrated Suite	NO
PFS Graph	1983	Spreadsheet + Charts	NO
Microsoft Chart	1984	Charts	YES: VER. 3.0 (1987)
Ashton-Tate Framework	1984	Integrated Suite	YES: VER. II (1986)
Chart Master	1985	Charts	NO
PC Illustrator	1985	Charts + Slides	NO
IBM Storyboard	1985	Charts + Slides	YES: VER. PLUS (1985)
Harvard Presentation Graphics	1985	Charts + Slides	YES
Freelance Graphics	1985	Charts + Slides	YES: VER 2.0 (1987)
Microsoft Excel	1985	Spreadsheet + Charts	YES: VER. 2.0 (1987)
Lotus Jazz	1985	Integrated Suite	NO
GEM Graph	1985	Charts	NO
Migent Ability	1986	Integrated Suite	YES: VER. 2+ (1993)
Harvard Graphics	1986	Charts + Slides	YES
Boeing Graph	1986	Spreadsheet + Charts	NO
Apple HyperCard	1987	Multimedia	NO
Quattro Pro	1987	Spreadsheet + Charts	YES
Microsoft Works	1987	Integrated Suite	YES: VER. 2 (1990)
Ashton-Tate Applause	1987	Charts + Slides	YES
PowerPoint	1987	Slides	YES: VER. 2 (1990)
Xerox Presents	1988	Charts + Slides	YES
Cricket Graph	1989	Spreadsheet + Charts	YES
Asymetrix Toolbook	1989	Slides + Multimedia	YES
Lotus Works	1990	Integrated Suite	YES
Storyboard Live	1990	Charts + Slides	NO
Presentation Express	1991	Charts + Slides	NO
Micrografx Charisma	1991	Charts + Slides	YES
WordPerfect Presentations	1992	Charts + Slides	YES

In this study, we excluded the analysis of database tools, even though some of those classified as “Integrated Suites” also included them. Relational database systems were tools almost exclusively used by software developers, for building new work tools such as inventory control applications, accounting systems, sales and transaction records, etc. While it was common to use these systems for generating printed management reports, they were not typically utilized as data sources for constructing graphical elements as charts and visualizations.

The second phase of the study adopts Michel Foucault’s archaeological method adapted to Design studies, that is: an effort to understand the prevailing discourses and discursive constructions that articulated the configuration of these artifacts within practices and conceptualizations also discursive and specific to the period, seeking to identify for which types of subjectification and conflicts these configurations were shaped. According to Foucault, the method seeks to “understand why some statements emerge more than others. What reasons lead to the materiality of a particular statement and not others?” (Foucault, 2008, p. 11, authors’ translation), or more succinctly, “how did a particular statement emerge, and not another in its place?” (2008, p. 39, authors’ translation). His method aims to trace the play of forces present, to understand that relations are not the product of a logical, planned, and rational evolution, but of disputes and forces often considered small or banal, yet active enough to provoke changes. In the case of Design, we seek to observe these changes in the configuration of artifacts, which are also a way for discourses to materialize:

> Design assumes the function of establishing control over the visual/imagetic discourse in which its object is inscribed. A discursive formation is not confined solely to text or verbal communication, just as design is not limited to what is apparent and consciously apprehended: the curtains in a hospital convey many things about the practices present therein; the partitions in a school speak to its practices and how they are organized and conducted [...] These arrangements and intentions are already present even before the first sketches of building plans and facades, as well as before any other type of design is conceived; Michel Foucault referred to them as statements (Ranoya, 2013, p. 77).

The fundamental question guiding this stage of the study is to what (discursive) needs the configurations of visualization artifacts are truly responding? Are they responding to a need to explore data extensively, as claimed to be the purpose of data visualization? Are they responding to the ease and scalability of producing these artifacts, as an attempt to industrialize their production to build such artifacts en masse? What then would be the determining requirements for the configuration of these artifacts, or, in other terms, the expressive limits and possibilities of these artifacts within what could, or could not, be called visualization at that time? The archaeological method applied to the study of Design artifacts, observing the concreteness of their making under the active forces that define them and their possibilities, helps us identify the discontinuous transformations undergone in the field, and explain how a practice that began with professionals in the healthcare sector with statistical experience, and which possesses all the typical characteristics of an object of Information Design, can be governed by other principles completely unrelated to either of the two fields of knowledge.

This investigation would not be able to comprehend the issues at stake solely through the observation of digital production tools of the time. It is equally necessary to observe them alongside the discourses and conceptions circulating within the same media. To achieve this, we made use of advertising materials aimed at the computer market in the early 1980s, both in print format and a promotional video developed in 1982 by Apple Computer, entitled "An Introduction to Business Graphics",[10] as well as other audiovisual materials from the period, consisting of documentaries analyzing the infancy of computer market and its products ("The Rise of Microsoft Excel",[11] "The Story of Visicalc",[12] "How Excel Beat VisiCalc & Lotus 1-2-3",[13] "Lotus History: The First Five Years",[14] "The Rise of Microsoft Windows Part 2: Windows 2x"[15]) and two episodes, one from 1988 and another from 1990, of the esteemed TV program "The Computer Chronicles," produced and aired by the American public television network PBS (Public Broadcasting Service), entitled "Spreadsheet Wars"[16] and "Windows 3.0"[17] (which contains analyses of the PowerPoint and Toolbook tools, newly released at that time). All of these materials addressed the available productive alternatives for emerging computerized work, confronting the internal dilemmas of the software houses themselves and the efforts and difficulties to make their products market leaders (or more specifically, to make them the standard tool for working with data in organizations).

10 https://www.youtube.com/embed/jTuYxWB3lOc>

11 https://www.youtube.com/embed/PI23HAEN63c?si=dVXuCGnCH8XYOrTC

12 https://www.youtube.com/embed/nDPD7U_M8yw?si=XE67FFcVM_-g88U4

13 https://www.youtube.com/watch?v=cRxrv8JjiT4

14 https://www.youtube.com/watch?v=_UTxmR5ryeE

15 https://www.youtube.com/embed/oNFqsvK2omQ?si=VaOqlk4JcyVPNZMT

16 https://www.youtube.com/embed/eAiZBUYNUBA?si=jrKMGVt9Si3LNsp8

17 https://www.youtube.com/watch?v=YewNEAIkbG4

3 Analysis and discussion

In observing the objects and their confrontation with the discourses evident in advertising arguments and audiovisual materials, three distinct moments for the production of charts and slides become clear, which we will refer to as: [1] spreadsheet calculation; [2] business graphics; and [3] desktop presentations. A branching out into what was, for a time, called [4] new media, was also identified, but it failed to gain traction in the corporate world of this period. The particular issues of each of these moments will be presented below:

3.1 [1] Spreadsheet calculation

This phase begins with the emergence of the first electronic spreadsheet, VisiCalc (1979), and extends until it was also the only solution of its kind available in the computer market, until the year 1983. The product by VisiCorp was revolutionary and qualified as the first Killer Application, a concept attributed to solutions so disruptive that they would be capable of mobilizing entire organizations to change their operations to take advantage of the benefits offered by a single software. VisiCalc was not just a Killer Application, but the first Killer Application in the history of computing, responsible for redefining personal computers – originally closer to video games than to the productive sector – into tools for work.

The innovation conceived by Dan Bricklin while pursuing his MBA at the prestigious Harvard Business School, and initially developed for Apple II personal computers by Robert (Bob) Frankston, operated exclusively as a sequential calculation tool. Despite being infinitely more rudimentary in its features, processed data, and flexibility than the spreadsheets available today, the paradigm of what a spreadsheet is, and how it operates, was defined there (and indiscriminately copied). It may be important to note that the paradigm established by VisiCalc is not the only possible way to work with sequential calculation processing: we currently also use another model, known as notebooks, which develop similar computational procedures but in a single dimension instead of the two (rows and columns) present in VisiCalc and copied by all other spreadsheets that succeeded it, to this day.

This first moment is fundamental because it brought about two critical transformations for the future production of charts and slides: the introduction of the personal computer (more accessible and scalable for organizations) as tools for work, and the offering of a use case, that is, the definition of a clear and well-defined flow of computerized work, (obviously) dependent on the use of VisiCorp's solution as the central tool to manage organizational activities.

In this phase, we do not have the real production of any information visualization with digital tools, since VisiCalc was not capable of generating charts or presentations, functioning only to process calculations. It was precisely this gap that made it an obsolete solution in less than 5 years.

3.2 [2] Business graphics

By 1983, computerized work had already become a fairly common condition in organizations and businesses across various market segments (at least in the group of countries classified as the "first world"). Private companies and multinational organizations in the United States were experiencing the yuppie culture (young urban professional), which signaled the conspicuous desire of the country's population for "office work," that is, working within business environments with (largely) computerized management activities.

In this context, corporate communication begins to be constructed to engage people and transform mindsets, always seeking objectivity, rationality, and efficiency. The emphasis on metrics, or more precisely on numbers, is a natural consequence of this condition. However, not everyone in a management meeting would be able to quickly grasp the meaning of a set of numbers projected in a table, as the yuppie emphasis on efficiency and objectivity would desire: hence the urgency for the use of charts that would translate this information into something more meaningful.

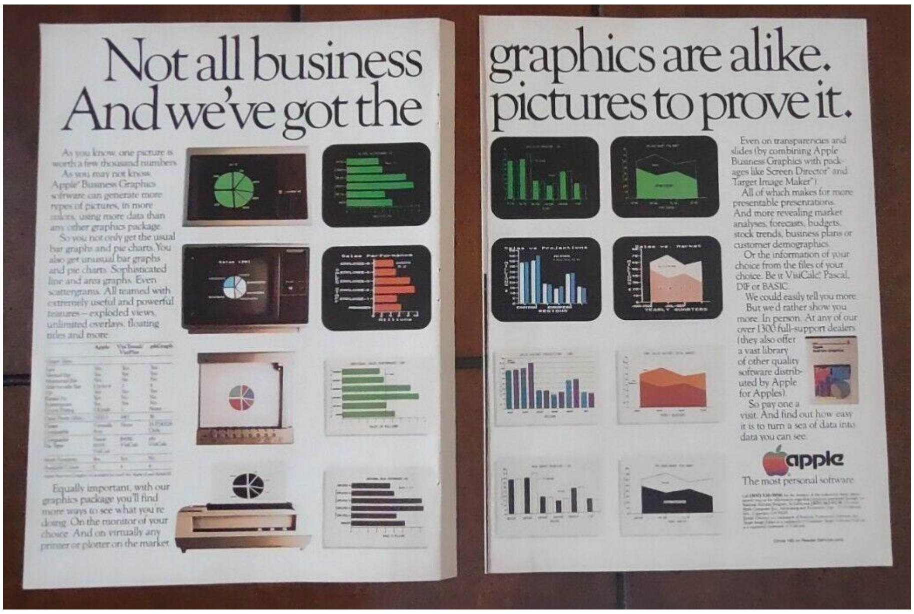

Figure 6 Promotional material from Apple Computer in the mid-1980s reinforcing the use of personal computers as tools for creating graphic-pictorial elements presenting data (*Business Graphics*). Source: Authors' collection.

The promotional material produced by Apple Computer in 1982, entitled "An Introduction to Business Graphics," is quite didactic in contextualizing this urgency. In its introduction, the following discourse is presented:

> The information war is on. it seems that nearly every day someone finds a new way of giving us facts, reports, printouts, analyses, forecasts, reviews, updates... a flood of materials designed to help us understand the changing world of business, but having a lot of information at our fingertips isn't always the best way of understanding what it means.
>
> In fact, what starts out as a lot of information often ends up is just a lot of numbers. That's where business graphics come into the picture. Business graphics is a tool for giving meaning to numbers, for showing relationships and trends, for clarifying and emphasizing and a way of communicating those meanings quickly, clearly and attractively.
>
> Business graphics turn a lot of numbers into a lot of answers. more and more people are understanding the advantages of graphics. That's why Apple business graphics was developed: it gives you the power of computer graphics, and the flexibility to use them where you need graphs the most.
>
> Financial forecast, sales reports, scientific charting. Whether you're working with the raw numbers, or making your final presentation, Apple business graphics is being used in over 6,000 offices today, because you need graphs to help you understand data.
>
> (transcript of the opening narration of "An Introduction to Business Graphics", 1982)

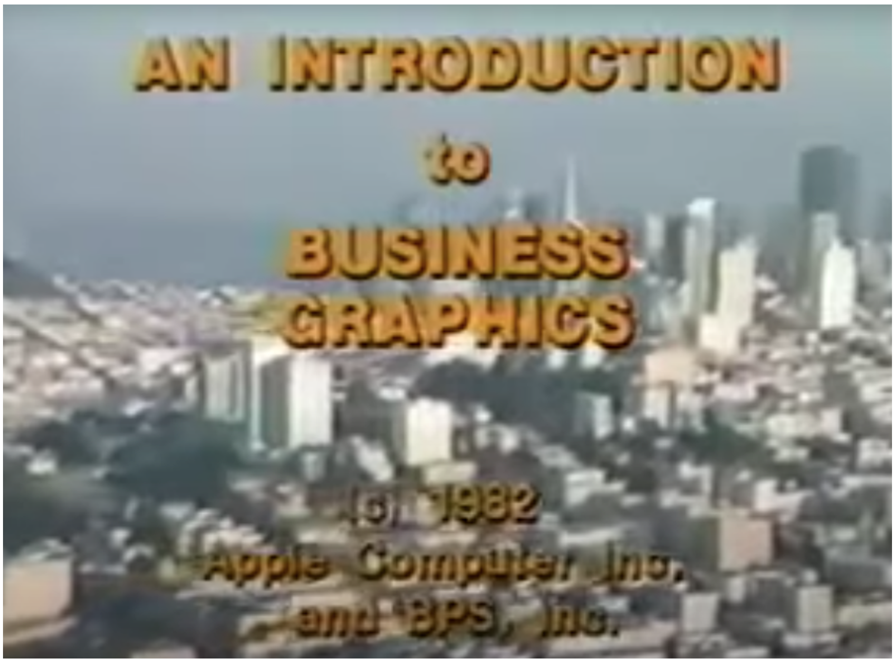

Figure 7 "An Introduction to Business Graphics," material produced by Apple Computer as visual literacy for businesses beginning their computerized operations.[18]

18 https://www.youtube.com/embed/jTuYxWB3lOc

The first (and last) competitor to VisiCalc (1979) in organizational operations is Lotus 1-2-3 (1983). This software replicated the same model and operational principle of its predecessor, but precisely featured the element that was absent in the first electronic spreadsheet: the creation of charts.

Following in the footsteps of Lotus 1-2-3, several other products emerged, such as Microsoft Multiplan, Borland Quattro Pro, etc. The Lotus product remained the dominant spreadsheet tool for almost a decade, only overtaken by Microsoft Excel in the mid-1990s (although this product was originally created by Microsoft in 1985 for the new Apple Macintosh computers).

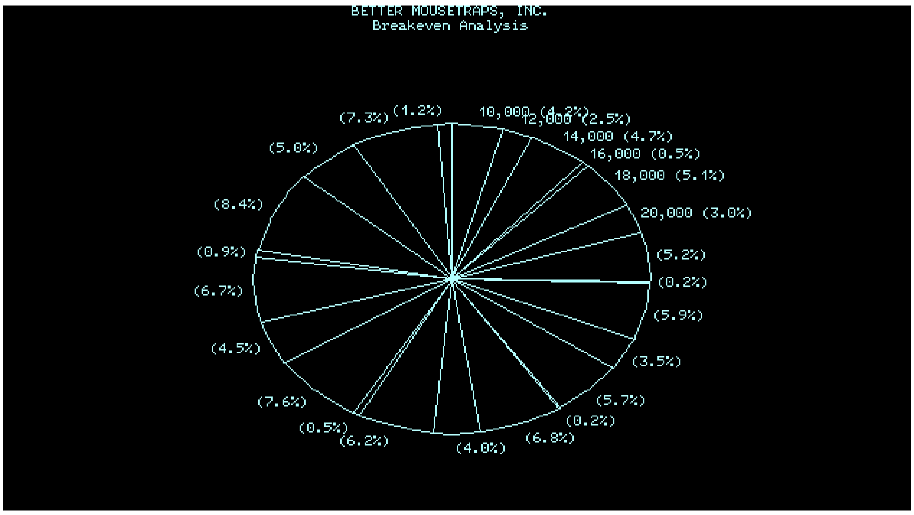

Figure 8 Pie chart generated by Lotus 1-2-3. Source: Author's collection.[19]

19 https://visse.vercel.app/v2-preservacaodataviz

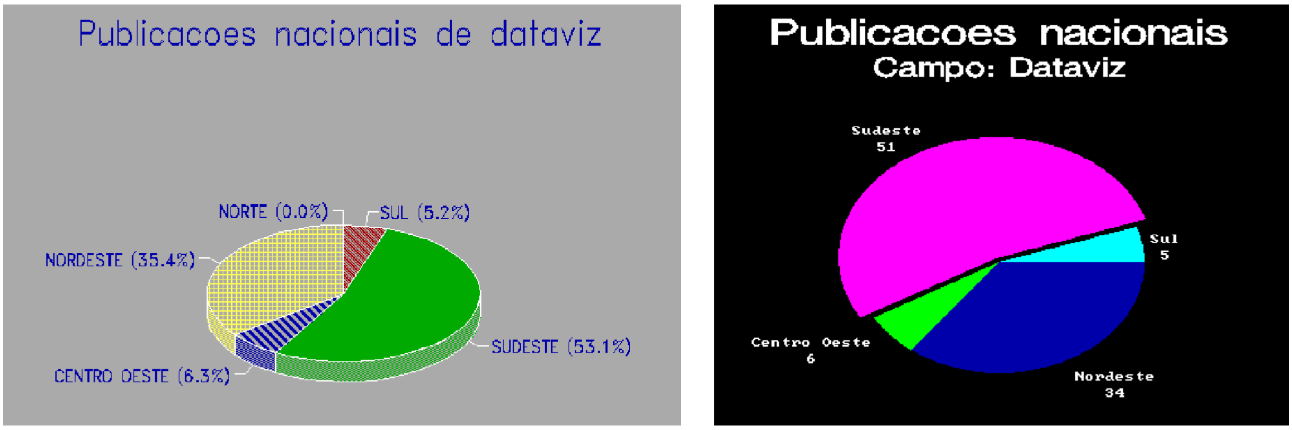

Figure 9 Pie charts generated by Borland Quatro Pro 1.0 (left) and Harvard Presentation Graphics (right). Source: Authors' efforts in software preservation.[20]

20 https://visse.vercel.app/v2-preservacaodataviz

Lotus's dominance was precisely due to the integrated way its solution could process data and automatically extract visual representations from them that could be used to communicate objectively and effectively what these data meant, through charts.

The period we classify as Business Graphics extends from 1983 to 1987 and is the phase where the use of a graphical language in the form of charts for expressing corporate data is consolidated. At this moment, we find a profusion of tools (PFS Graph, Microsoft Chart, Chart Master, PC Illustrator, GEM Graph, among others) whose purpose was not to calculate or process data, but merely to organize them and generate, from them, the pictorial elements so essential for business.

The concept of data visualization, along with the grammar of charts produced by various available tools, was shaped to meet corporate needs, not others. We understand that data visualization was also used in the scientific field and in media communication. Neither of these fields depended on digital production tools for visualization development, but many of them adopted these same tools to formulate a base chart that would be used as a reference for the construction of a final graphic element, produced by illustrators, designers, or technicians. Consider the statistical graphics published in newspapers that would make Tufte proud: they were static illustrations developed by designers working in the editorial production line of media outlets, using digital illustration tools or manual paste-up work, maintaining graphic fidelity of statistical proportions through a printed proof, created by a spreadsheet. The use of tools targeted at the corporate context as a basis for validating graphic elements used in scientific or media products certainly limited and/or shaped the language and expression of visualization in other sectors as well, but they were not aimed at the nascent Desktop Publishing industry, which was more interested in software to simplify and expedite the configuration and printing processes of editorial artifacts (such products are not suitable for the discussion proposed here but were also raised during the research).

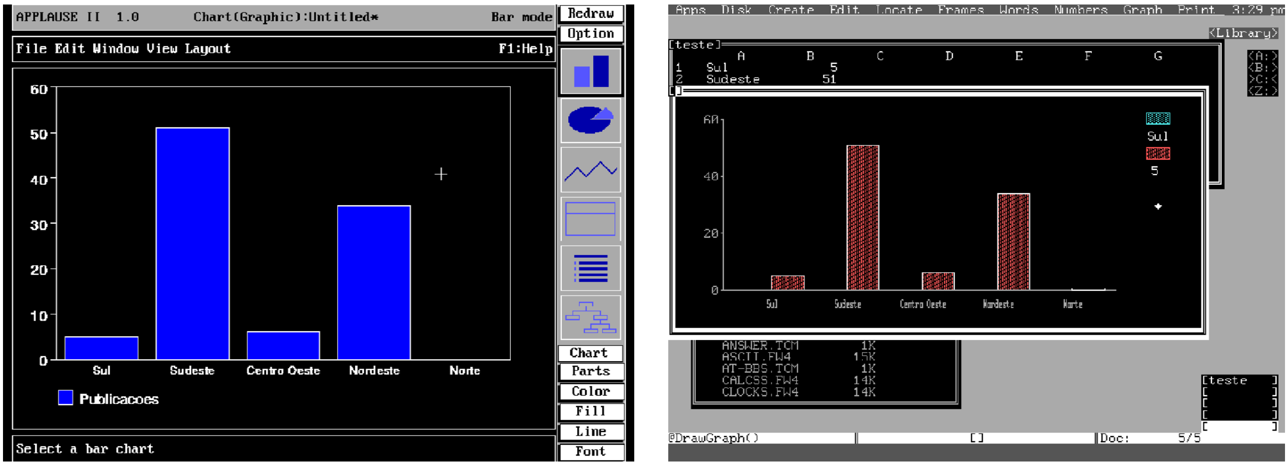

Figure 10 Bar charts generated by Ashton-Tate's Applause II 1.0 (left) and Framework IV (right). Source: Authors' efforts in software preservation.[21]

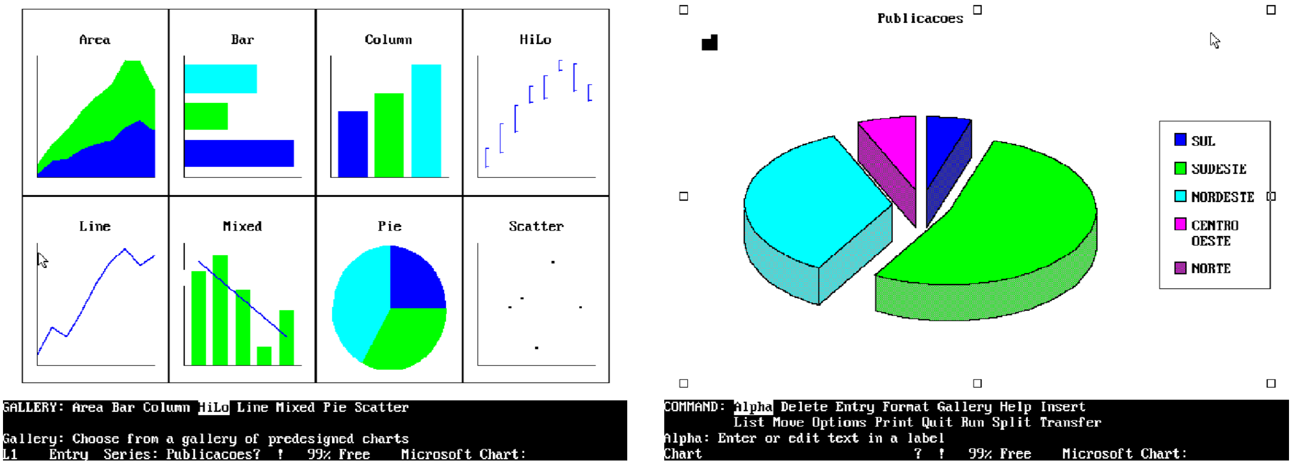

Figure 11 Charts being generated by Microsoft Charts 3.0. Source: Authors' efforts in software preservation.[21]

21 https://visse.vercel.app/v2-preservacaodataviz

It becomes quite clear in this phase that production tools (in this case, digital ones) paved the way for artifact construction processes. It was they, and their inherent logic, that shaped what was (or was not) possible to be done in a context reinventing its own practices. At the same time, the tools themselves are also shaped by the forces and needs existing in the context they serve. If a digital production tool like VisiCalc was unable to produce charts, it would urgently need to incorporate such a feature, or it would perish in the face of other solutions better adapted to current demands. The key point to consider here is that these transformations occurred in the presence of a power play. Its tensions, conflicts, and influences that shaped these products, and consequently, a whole new language that expresses itself from them. This does not prevent other products and solutions from proposing different forms and alternative paths for production, but the vast majority probably conformed to the most intense and inevitable forces and needs, thus instituting the most common and accepted (or copied) conventions in a context, also relegating alternative expressions to a peripheral or exceptional condition. Of all the forces that shaped the language of data visualization, the demands of private organizations and large multinational corporations were the strongest.

In the documentary “The Rise of Microsoft Windows Part 2: Windows 2x”,[22] supported by both written works on Microsoft’s workplace environment in the 1980s and interviews with some of the company’s most important employees at the time, there is a recurring assertion that the release of the second version of the Windows platform, as well as the platform developed for IBM, the OS/2 Presentation Manager, would only be considered complete when it was possible to run the Excel spreadsheet on them. Excel was understood within Bill Gates’ company as the quintessential corporate product, and one that would enable them to dominate the coveted corporate environment. That is, at least, until they glimpsed the next phase of work computerization:

22 https://www.youtube.com/embed/oNFqsvK2omQ?si=VaOqlk4JcyVPNZMT

3.3 [3] Desktop presentations

A third moment that brings about significant transformations in the way these graphic elements are elaborated follows the release of PowerPoint by Forethought, a company acquired by Microsoft just 3 months after its first product launch. The product itself needs no introduction, as it remains the market leader in electronic presentation software (slides) for over 30 years. PowerPoint was not the first tool developed for slide construction: before it, we had IBM Storyboard (1985), Harvard Presentation Graphics (1985), Lotus Freelance Graphics (1985), Harvard Graphics (1986), and Ashton-Tate Applause (1987). All of these tools had sophisticated features for organizing and structuring data, allowing them to generate charts as part of their functionality, aligning well with the principles of Business Graphics. But this was not the case for PowerPoint.

23 https://visse.vercel.app/v2-preservacaodataviz

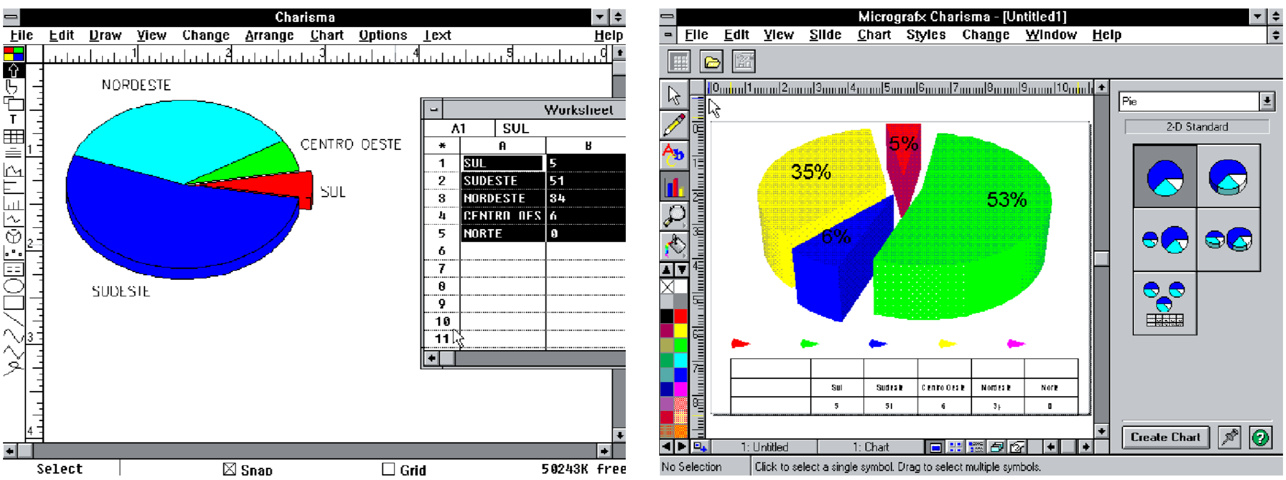

Figure 12 Pie Charts generated by Micrografx Charisma 2.0 (left) and 4.0 (right). Source: Authors’ efforts in software preservation.[23]

Solutions that came after PowerPoint, such as Xerox Presents (1988), Micrografx Charisma (1991), and WordPerfect Presentations (1992), maintained a complex set of functions and features for building charts, attempting to position themselves as more comprehensive products for slide production, and equally more complex than Microsoft's solution. We can recognize that Gates (and the purchase of Forethought was a personal decision of his) was truly a visionary in understanding what was to come in the corporate context of the late 1980s.

Charts and data visualization, or more specifically, numbers processed by spreadsheet calculations, ceased to be the focus of management activities in organizations, which shifted their efforts to internal communication as a whole. The presentation of data, sales targets, revenues, projections, and everything else constituted from charts generated by spreadsheets remained important for these organizations, but now they were just part of a larger process that sought to engage and coordinate efforts through communication strategies, rather than solely through numbers and data presented.

This phase extends concretely from the full adoption of PowerPoint in the early-1990s until the end of the artifacts analyzed in 1995, but it is perfectly plausible to assert that the inherent logic remained very much present, or remained unquestionable until cable internet and devices connected to the network permanently became common in the mid-2000s.

What Gates was able to foresee is that Desktop Presentations were the entirety of computer media within the small organizational universe. Slides became PowerPoints, just as photocopies became Xerox, decades earlier. Microsoft's bet was on simplicity and ease of production in this media, against the complexity present in competing tools, in their efforts to incorporate more and more features. There is therefore a gap between the one that became the tool actually adopted for slide production, and the other options. But the centrality of all is, in fact, communication in bullet point form: direct, imperative, quick, and emphatic, also incorporating other elements such as charts, diagrams, flowcharts, illustrations, decorative pictographic elements, and photographic images digitized through scanners.

It is necessary to reinforce that this media, like all charts previously produced up to this point, were presented to their respective audiences in three possible forms: on paper printed through dot matrix or laser printers from the organizations themselves; in the form of presentations made with transparencies enlarged by overhead projectors, printed by specialized graphic bureaus; or through 35mm slides projected using slide projectors. Until around 1992, there were no projectors directly connected to computers so that their screens could be enlarged and projected for a group of people, and even at this time, this type of technology was expensive and inaccessible. Robert Gaskins, one of the creators of PowerPoint at Forethought, was the first to make a slide presentation using a digital projector directly connected to the RGB output of a computer, at a Microsoft meeting in February 1992. He used – of course – the third version of the company's product to present the slides, a version developed to meet this specific need, as something to be shared throughout the organizational culture from then on.

This Microsoft meeting in Paris is an important milestone for corporate media because PowerPoint was used to plan presentations (or their speaker notes), but not to deliver them. It is from this point onwards that slide tools began to be directed towards the process of presenting information as well, and the logic of Desktop Presentations reached its zenith (and as expected, with a significant time lag for countries not considered "first world").

During this period, data visualization, or charts, assume a complementary and secondary role in relation to what needs to be communicated. If during the era of Business Graphics, numbers and data were the entirety of corporate communication – and the implicitly instituted philosophy was that numbers spoke for themselves – they now comprised only a portion of the corporate information being communicated.

The syntax established in this consolidation of Desktop Presentations, and in PowerPoint as the standard slide presentation tool, remains largely unchanged since then; new tools have emerged, including as a result of technologies that facilitate online collaborative work, but the paradigm of how a slide presentation is structured, its language, or what it should contain, continues to be subject to the parameters defined during this period.

3.4 [4] New media: A discarded path

New media is a more recognized area within the editorial field of Design. These are the first productive experiences seeking to treat computers (and their screens) as a new medium, not just a simple tool, producing interactive content (within the limits of the computing capabilities of the time).

Among the set of tools analyzed, Asymetrix's Toolbook, a company owned by Paul Allen (a partner of Bill Gates at Microsoft), emerges as an intriguing solution, paralleled with PowerPoint in one of the 1990 episodes of the TV program "Computer Chronicles", both positioned as innovative ways to make computers a new medium and produce content to be consumed on them. Despite a valid argument, the two tools worked in absolutely different ways. We can classify Toolbook as one of the first multimedia authoring tools, along with the preceding Apple HyperCard, at a time when this category of tools did not yet exist. HyperCard itself, despite being profoundly innovative, did not have any impact in the organizational context, as Apple products represented a very small fraction of the installed base. It is worth mentioning that it was significant in another aspect, serving as a major influence for Tim Bernes-Lee in creating the specifications for the World Wide Web (WWW) at the European Organization for Nuclear Research (CERN) in 1989.

If slide editors like Micrografx Charisma or WordPerfect Presentations were considered too complex for adoption in the corporate world, an authoring tool involving programming, interface composition, and software compilation certainly would find no support there.

Today it seems simple to understand why the corporate context discarded them: these tools relied on very artisanal and laborious programming work, going in the opposite direction of expectations for automated and quick responses. Multimedia production tools had immense potential to produce innovative artifacts and could have been smart and flexible alternatives to Desktop Presentations. But they weren't. They didn't gain any traction in the corporate environment.

Many production companies, advertising agencies, design studios, and software houses developed multimedia products in the form of presentations for large companies, but they didn't address everyday communication or the day-to-day issues and processes; they were exceptional productions for events and important occurrences, crafted through highly specialized work, with months of planning.

Even in the early 2010s, the publishing industry attempted once again to produce multimedia and interactive artifacts, this time in the form of digital magazines for new mobile devices like the recently launched iPad. This too was a frustrating experience, stemming from the same difficulty as before: programming these artifacts with very peculiar interactions involved an excessively laborious, almost artisanal programming work, and was unsustainable for the weekly or even monthly frequency of new issues. Over time, such products were restricted to digital versions of printed layouts, with much simpler interactions like the ability to scroll through text on the screen.

4 Conclusions

A certain discomfort is noticeable and palpable among Information Design professionals, especially those working with data or information visualization: this entire field seems to have been theoretically and empirically abducted by the practice and literature originating from computer science.

This is not just a feeling but something easily demonstrable: the Visualization Publications[24] website claims to compile all articles published[25] on the theme of data and information visualization, yet its sources are only the IEEE Visualization (IEEE Vis) and EuroVis journals, which are focused on visualization from the perspective of engineering and computer science, with one of them belonging to the Triple-E Institute of Electrical and Electronics Engineers (IEEE). None of the sources cover Design studies, nor the issues of graphic language so important to Information Design.

A category as clearly qualified as an object of Design finds itself (or we believe it finds itself) hostage to computer science, whose thinking acts as an incessant machine for producing rules, scripts, and heuristics for automated and dehumanized work, contrary to what the act of design proposes as a reflective, careful practice with individualized attention to each artifact produced. The sensation reported by many professionals dealing with visualization is that attempting to make sense of something, exerting efforts to configure new graphic elements developed entirely to make information better and more meaningful, is perceived as a significant waste of time and resources when there are ready-made software solutions capable of producing something within already tested and validated norms and standards, which will work reliably. The design practice for which a

24 https://vispubs.com

25 "Vispubs was created by Devin Lange to aggregate all visualization publications into a single website, and make it easy to find resources related to publications." https://bispubs.com/about designer is prepared seems to have become irrelevant due to advances in computer science.

But we understand through this study, framing the problem with the archeological method adapted to design, that this is not really the issue, or at least, it would not be computer science (or even computer scientists and engineers) the true culprits of this downgrading of design practice and the peripheral condition in which Information Design has been placed in discussions about visualization.

The confrontation between the observed software and the widely demarcated power play in the documentaries, TV programs, and advertising of the period of dense digital transformation addressed here provides us with material evidence that even computer science would be far from being a protagonist in these discussions and in shaping the guiding principles or the culture present in visualizations.

The extensive literature produced in the field of computer science on the subject is mostly an operational response to demands and needs made to (and not by) the technology industry, as providers of tools. The principles found in the literature from this perspective are always conditioned to visualization as the corporate universe presupposes or expects it to be. And, naturally, it expects its production to be automated and operationalized by anyone, without the need for a specialized professional for this purpose.

A collection of predefined (and rigid) typologies for configuring charts or visualizations, as proposed by Wilkinson (2005) – which fuels current software with its “variety” of available charts – is clearly the result of a computational approach to the problem, delineating taxonomies for existing visualization artifacts and synthesizing them into a general model that can be reproduced infinitely, without any additional effort. What is not transparent is that this work, necessary for the automation of these graphic constructions to be implemented in software, is not a requirement imposed by computer science on the construction of visualizations, but one established by the corporate world to which computer products are subjected. Similarly, the recent inclusion of generative artificial intelligence tools in this software operates in the same register and is a product of corporate demands for agility and reduction of workforce attributed to operational activities, such as the creation of charts and slides. The appropriation of what is materially available for Machine Learning to decode patterns and generate reconfigurations from them in a matter of seconds are clear products of computing advancement; but the almost no-reflexive urgency of their implementation in workflow comes from a point in the production chain that supersedes any interests of this field and instrumentalizes them (both the advancements and the interests).

In the eagerness to judge the actors hindering the Design’s protagonism over the design of these artifacts, designers often condemn the executioner but not the true mastermind.

References

Burke, C., Kindel, E., & Walker, S. (2013). *Isotype: Design and contexts 1925–1971*. Hyphen Press.

Cairo, A. (2019). *How charts lie: Getting smarter about visual information*. New York: W. W. Norton & Company.

Culkin, J. M. (1967). A schoolman's guide to Marshall McLuhan. *The Saturday Review* (pp. 51–53).

Cunha Lima, R. (2010). Otto Neurath e o legado do ISOTYPE. *InfoDesign – Revista Brasileira de Design da Informação*, *5*(2), 36–49. https://doi.org/10.51358/id.v5i2.54

Foucault, M. (2008). *Arqueologia do saber*. Rio de Janeiro: Forense Universitária.

Manovich, L. (2013). *Software takes command: International texts in critical media aesthetics*. London: Bloomsbury Publishing.

Manovich, L. (2001). *The language of new media*. Cambridge: MIT Press.

Ranoya, G. (2013). *A intuitividade nas mídias interativas*. São Paulo: Escola de Comunicação e Artes da Universidade de São Paulo.

Rheingold, H. (2000). *Tools for thought: The history and future of mind-expanding technology*. Cambridge: MIT Press.

Twyman, M. (1975). The significance of Isotype. In M. Twyman, *Graphic communication through ISOTYPE* (pp. 7–17). Reading: University of Reading.

Twyman, M. (2004). Further thoughts on a schema for describing graphic language. In *Proceedings of the 1st International Conference on Typography & Visual Communication History, Theory, Education 2002*, Thessaloniki, Greece (pp. 329–350).

Twyman, M. (1982). The graphic presentation of language. *Information Design Journal*, *3*(1), 2–22.

Twyman, M. (1979). A schema for the study of graphic language. In P. A. Kolers, M. E. Wrolstad, & H. Bouma (Eds.), *The processing of visible language* (vol. 1, pp. 117–150). New York & London: Plenum Press.

Wagner, R. (2009). *A invenção da cultura*. São Paulo: Cosac Naify.

Wilkinson, L. (2005). *The grammar of graphics*. New York: Springer.

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