



Visual Learning – A Year After

VLL Papers. No. 9 (1/2019)

Szerkeszti Benedek András és Nyíri Kristóf
Edited by András Benedek and Kristóf Nyíri



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BME GTK Műszaki Pedagógia Tanszék
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The talks here printed were given at a follow-up meeting to the 8th Budapest Visual Learning Conference, 2018, the meeting being held on May 23, 2019, at the Hungarian Academy of Sciences. Talks given by András Benedek (organizer of the event; Prof. of Education at the Dept. of Technical Education, BME), Kristóf Nyíri (Member of the Hungarian Academy of Sciences), Petra Aczél (Prof. and Head of Institute of Behavioral Science and Communication Theory at Corvinus University of Budapest), Anna Somfai (Central European University), Irma Puškarević (University of Novi Sad), Andrea Kárpáti (Prof., Institute of Behavioral Science and Communication Theory at Corvinus University of Budapest), Péter Neuman (PhD, Dept. of Phil. and History of Science, BME), Rita Lisa Vella and Anna Chiara Sabatino (both holding a PhD in Communication Science, University of Salerno).

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Visual Learning – A Year After
Visual Learning Lab Papers
ed. by András Benedek and Kristóf Nyíri

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András Benedek

Continuing the Visual Learning Project

It was almost exactly one decade ago, in October 2009, that the philosophical discussions I had with Prof. Kristóf Nyíri on the role played by time and images in human activities led the expert group around me dealing with the development of education to the idea to establish – building on our researches investigating the more and more complex impact of mobile communication tools on learning – a Learning Lab within the Budapest University of Technology and Economics. Although both topics – mobile communication on the one hand, visual learning on the other – are equally important both from the theoretical and practical aspects of education, we finally chose the issue of *visuality* and started to examine it from an interdisciplinary approach. The success of our first meeting – a presentation given by Prof. Dr. Kurt Röttgers (FernUniversität in Hagen, Institut für Philosophie), visiting professor at the Department of Technical Education, and a brief talk given by Prof. Alan Knox (University of Wisconsin–Madison, Department of Educational Leadership & Policy) – and the interest we experienced gave us the impetus we needed to go on.

The widest possible interpretation of *visuality* awakened the interest of the representatives of several disciplines. Linguists, psychologists, sociologists and experts in technical sciences joined the more and more exciting program of our professional platform that was initiated by a philosopher and an education researcher. The evolution of international dialogue was strengthened by the Visual Learning Conferences organized each year between 2010 and 2016; in spite of its initial workshop conference nature – 30-40 scientific lectures – with the talks of European and even overseas researchers, it slowly outgrew the modest university frameworks. Of course, electronic publicity was available, as well, through the abstracts, presentations and our web page (www.vll.bme.hu), and at the same time,

we launched a book series, too (*Visual Learning*). The seven books in this series included the studies that were written by the speakers of the outstanding lectures held at the conferences and were strictly edited; the series was published by The Peter Lang Publishing Group.

Looking back at the results of the former years, at the turn of 2017 and 2018 we made a new decision. Stepping out of the routine of organizing our conference each year, we prepared a more significant event, and we won the Hungarian Academy of Sciences over to support the organization of the *8th Budapest Visual Learning Conference (VLC8)*. We faced some relevant questions: *What professional responses would we meet? How intense and what quality interest could be awakened by lectures that were relevant in their field (Communication – Culture – Consciousness) and were connected to the broad and complex interdisciplinary topic of Visual Learning? How would we be able to create a synthesis summing up the given topics and to provide a summative evaluation of an exciting period of co-thinking?* These questions were partly responded by the interest in the conference (150 participants and 93 lecturers), and the results of the international event can also be judged by the reader. We made some changes in the method and genre of publishing our findings. Considering the topic timely and worth further researches, we decided to compile a new series of three books to be published by the Hungarian Academy of Sciences and Budapest University of Technology and Economics. The slightly altered title of the new series, *Perspectives on Visual Learning*, refers to this new phase. However, the titles of the volumes show that arriving at the end of a development stage, we undertook something more: a comprehensive reevaluation. This is why the first volume, comprising 21 chapters, was titled: *Vision Fulfilled: The Victory of the Pictorial Turn*. It took only a little more than half a year to make this book available: the electronic form has been accessible since December 2018 and the print form since the spring of 2019. The second book was titled: *Learning and Technology in Historical Perspective*, and it contains 14 chapters. The studies were connected to a wider thematic of education and teaching, the authors, again, were teachers, sociologists, philosophers, media researchers and technical experts. In addition to their theo-

retical approaches, the chapters introduced the practical experiences of the relevant researches, as well.

We have now reached the final volume of this series. Its title, *Image and Metaphor in the New Century*, makes it clear that we have arrived at an essential phase of our story; however, the volume is not the closure of something but deals with new exciting issues that are topical from a scientific point of view. Placing the notion of metaphor into a broad context, the authors deal with new phenomena of visuality indicating the wider environment of education as part of a system of organic interrelations. They show us what challenge the complexity of our world means for the disciplines in terms of the subject and the applied methods. This is why we consider it essential that we have had the opportunity to adopt a multidisciplinary approach in these volumes and their more than fifty chapters, demonstrating the fascinating issues engaging many researchers; publishing the results of their thinking may attract further professionals to these developments. I am very grateful to Kristóf Nyíri who rendered us enormous help in the professional preparation of the volumes, in creating their final form, and without whose ideas, constructive proposals and generous editing work this exciting new series could not have been born.

Life is going on, our research community, which is also formed by spontaneous impacts, faces new perspectives. I wish to contribute to the hoped-for and demanded continuity with two thoughts. On one hand, based on the successful conferences and rich publications of the past decade, I reckon that it has been proved that in terms of complex phenomena like the impacts images exert on our lives, multidisciplinary approaches are extremely up-to-date both as research topics and as programs. In terms of the common activities of the various disciplines, this field is hiding prime opportunities that might fulfil great hopes through mutual interest and the comparison and constructive critical elaboration of partial research results. This speciality may offer a perspective even in the current situation of the domestic academic sector, and, in addition to basic researches that are obviously important, it may show some good examples of the domestic contribution of applied researches. In my opinion, we can

see relatively few researches of this type, implemented with a very low budget, that have exerted such a well-perceptible impact on the international field and various disciplines. My second thought draws attention to the wide-spectrum collaboration possibilities of the academic and the university research sphere. Its frameworks have been shaped by the latest years' developments in a new way. Through its scientific committees the Academy as a scene provides an orientation as well as a research and communication scope that university research communities can join with their colourful professional identities in a constructive way. It would be worth carrying on this colourful research cooperation indicating progression in its changes by involving new topics and maintaining common fora in the future.

Kristóf Nyíri

Visual Cognition: The State of the Art

A decisive insight within today's philosophy of images is the recognition that objects of vision are as a rule moving ones, rather than static. Vision and movement are bound up with each other. It has of course been known for a long time that the seeing eye is never at rest, but that is not the main point here. The main point is that when we open our eyes to the world, the picture offering itself is, normally, a moving one. Likewise, our visual mental images tend to fluctuate, rather than stand still. Still images are man-made artefacts, compromises forced upon their creators by there not being technical means to put together moving ones. Drawing *image sequences*, the precursors of the animated image, of course has had a long tradition; and by the twentieth century there emerged film, animation, video. However, it was not until quite recently that handling and even creating moving images became possible on one's own computer. This latter development forms the immediate technological background of the pictorial turn, set on its way to victory. We now perceive still images as limiting cases of moving ones, we realize that it is the moving image that embodies what an image really is. Moving images are not in need of interpretation, or captions, or verbal context, as opposed to the way still images are. The notorious problem of the ambiguity of the static image herewith disappears. Let us add that new light is here shed on another notorious problem, that of the existing or not existing grammar/syntax of pictures, discussed in volume 3 of the series *Perspectives on Visual Learning* both by Forceville and by Bárány. Just think of the primal situation of one looking around in one's visual surroundings: looking at this *and* then at that, *or* at that, *or not* looking at something.

Moving images happen in time. Images and time hang together. There is an intrinsic connection between how images mean and how time flows. We cannot gain a proper understanding of the func-

tion of images unless we have an at least approximate notion of what time is. On the other hand, the concept of time cannot be grasped through verbal definitions, as the history of philosophy has so depressingly shown. There is a famous passage by St. Augustine: “What then is time? If no one asks me, I know: if I wish to explain it to one that asketh, I know not.” Augustine’s embarrassment was understandable, since clearly he possessed certain perceptual images related to time, did not however have at his disposal, as neither have we today, a verbally articulated explanation. What we possess are verbal *images*, in the sense of verbal *metaphors*. Time cannot be conceptualized except by metaphors, and so ultimately by images, of movement in space. A fundamental metaphor is that of the *flow of time*. It is a complex figure of thought, synthesizing the experience of the passage of time as a physical force on the one hand, and the experience of the present as gradually receding into the past on the other. I will within minutes come back to the topic of metaphors, but let me first embark on a different train of thought by noting that the concept of the flow of time can be very well expressed in some specific *visual* languages: the languages of deaf communities, the language of gestures.

There is every reason to believe, and this is the second decisive insight within today’s philosophy of images, that the language of gestures is the primordial language of humankind. My Postscript to volume 1 of the series *Perspectives on Visual Learning* provides detailed arguments, here let me just refer to the central point: verbal language could not have possibly emerged before the coming into being of visual language – the language of gestures and facial expressions. Verbal language rests on conventions, the language of gestures rests on immediate visual resemblances. In order to form conventions you cannot but use a language, and in the course of the development of verbal language – we are speaking of an evolution that probably happened as late as perhaps 30,000 or so years ago – the only language humankind had been in a position to use was visual language. Now once the fact of the historical priority of visual language is accepted, the primacy of visual thinking, too, must clearly be recognized. Our early ancestors were, obviously, thinking beings, however

since they did not yet possess a verbal language, their thinking must have been sensual, and indeed, fundamentally, visual.

The emergence of verbal language – spoken language – based on the language of gestures and facial expressions, must have been an immensely complex process, with so-called mouth-gestures – sound-producing mouth movements, most importantly lip movements – probably playing an essential mediating role. Now visuality is primarily bound up with the right brain hemisphere, while symbolic – verbal, arithmetical – processing with the left one. The rise of verbal language must have placed enormous psychological pressures on the generations subjected to the process. Imagine the accomplished orator of gesture language having to cope with the upcoming of spoken language. Stammering, he must have been looking for words. It is in this light we must see the role of early, and even contemporary, rhetorics. Rhetorics is not about the pictorial embellishment of ordinary spoken language. It is about recovering the original sensual-pictorial content having become buried under mere words. The Budapest Visual Learning Lab has had the good fortune of being able to count Petra Aczél, world-renowned theoretician of rhetorics, among its contributing members from the very beginning.

Developing through the phases of pictographs and syllabic writing, alphabetic writing emerged roughly around the 8th century B.C., in Greece. It was a real blow to visual thinking. It used no word spacing, as neither did early Latin texts, thereby making the optical recognition of single words difficult, with reading out loud the only option: you understood what you heard, not what you saw. This changed in the following centuries, but there still remained dramatic tensions between visuality and textuality, tensions wonderfully brought out by Anna Somfai's chapter "Visual Thinking in Medieval Manuscripts", in volume 2 of our series *Perspectives on Visual Learning*. Medieval manuscripts could be replete with elaborate illuminations and, even, small paintings, but let us add that, as William Ivins classically pointed out in his *Prints and Visual Communication*, they were not accompanied by scientific drawings, since in the copying process they would have been inevitably distorted anyway. The technology of printing woodcuts, etchings and engravings was unknown in Europe

until as late as 1400 A.D; then came book printing with the invention of the movable type by Gutenberg, but even after Gutenberg pictures were relatively rare in humanities publications, since both for the author and the printer to deal with images was much more cumbersome than to deal with texts. With the arrival of the age of photography this began to change, but the change was not radical: humanities authors as a rule did still not add photos to their typescripts, they were happy to type away on their typewriters, pouring out words that dealt with words, even while cinema and television completely altered the culture surrounding them. The radical change, as we have claimed by way of introduction, came with the computer, first enabling authors to work with still images, and then, finally, with moving ones.

The full vocabulary of verbal language must have consisted, in its earliest phases already, mainly of metaphors – I am returning to the topic of metaphor. The meagre core vocabulary could not but refer to the human body itself – its parts, postures, and movements; any extension must have relied on a transposed mode of speech. But let me point out that even gesture language already made use of metaphors. It is indicated at this point to refer to Wilhelm Wundt's *The Language of Gestures*, the original German editions published around 1900. Wundt here claims that gesture language has “an originality and naturalness such as speech neither possesses today nor has ever had in any forms hitherto uncovered by linguistics”, and agrees with the view according to which “gestural communication is the original means of communication”. He first analyzes what he describes as “concrete” gestures, but then introduces also the notion of “symbolic” gestures, of which he writes: “The over-all character of the symbolic gesture ... consists of transmitting the concept to be communicated from one field of perception to another, e.g. implying a temporal conception with spatial means or depicting an abstract idea physically.” Wundt appears to be not only an early forerunner of conceptual metaphor theory, a fact not known to Lakoff and Johnson, but also of the conceptual metaphor approach as applied to the visual – a fact not known to leading figures recently pursuing research on the subject. And let us here add another idea to the theme metaphor

and visuality, an idea that was indirectly alluded to in the present talk some minutes earlier: even verbal metaphors express what they express only by virtue of sensual, mostly visual, images. The Postscript, mentioned earlier, to the first volume of our series *Perspectives on Visual Learning*, provides some references backing this idea; just now it should suffice to recall a brilliant passage by the Jesuit Stephen J. Brown, dating back to 1927: metaphor amounts to an “imported image coming vividly before our mental vision, while the notion which is the real subject of the discourse momentarily fades into the background, and is seen only through the image”.

One of the very few who were still aware of Stephen Brown in the post-WWII era was art historian and psychologist Rudolf Arnheim. He extensively quoted Brown in a 1948 essay. At the time, Arnheim still had a long way to go before writing his 1969 magisterial book *Visual Thinking*. That book was the first indication that after decades in the wake of the linguistic turn, a pictorial turn might follow. For quite some time it did not happen. In the past few years however the trend has changed. I believe that the Budapest Visual Learning Lab, during the first ten years of its existence, has contributed to that change.

Petra Aczél

Rhetoric: The Primordial Power

In fact, what is primordial remains unheard; it is not self-evident from the beginning, nor do we know how it manifests itself to us – says Ernesto Grassi in his preface to the volume titled *The Primordial Metaphor* in 1994. By the term primordial we are brave to presume that there is a beginning and a persistence; that there is the original experience of meeting and being in the world, that there is an ancient source of energy. How can rhetoric be considered the primordial power of communication?

It has been nine years since I first had the honour to dwell upon rhetoric as visual and sensual within the academic circle of the Visual Learning Laboratory. It is then almost a decade that I invested – with the indispensable intellectual and scholarly support of professor Kristóf Nyíri – into the quest for a rhetoric that is not visual in terms of the target domain but inherently, originally sensual.

This quest has been worth every step of its way, though meant a disproportionately armed battle with enduring interpretations of rhetoric as the verbal art of persuasion. Entailing eight published essays in the *Visual Learning* book series, my search was indeed made to find the primordially visual-sensual in rhetoric. Instead of a big or a little rhetoric, a deep rhetoric, that is, a novel perspective of the two-millennia-old faculty which unveils the capacity rhetoric has beyond the verbal. I also wanted to follow the urging message I. A. Richards delivered in 1930 saying that “so low has Rhetoric sunk that we would do better just to dismiss it to Limbo than to trouble ourselves with it – unless we can find reason for believing that it can become a study that will minister successfully to important needs”. In my view and endeavour, the future of rhetoric can lay in the success of rediscovery of its relevance for and within the visual-sensual domain.

Actually, the visual has seldom been focused in rhetorical theory. Even though rhetorical persuasion and tropes (both exploiting the visual, the non-verbal) have attracted notable scholarly attention throughout the centuries, if it were not for the metaphor, rhetoric would have been practically excluded from the visual realm. Even though the 21st century has brought a new, more visual mindset to the interpretation of rhetoric, the visual rhetoric this thinking has bred seems to be more about the application of the rhetorical instrument to pictures, visual ads, films or spaces than about the identification of the considerable extent rhetoric is visual-sensual in itself. There are, however, several earlier and contemporary scholars who dedicated their theoretical ventures to this latter concept, assuming that there is certainly more beside the metaphor with which the visual theory of rhetoric can be informed. Giambattista Vico, the innovative rhetorician from the 18th century, followed by the neo-humanist Ernesto Grassi in the 20th century enforced the idea of an originary language that reflects the experience of wonder (thaumazein) in our meeting with the world. This experience is not at all rational but uses our organs, our bodies and senses. Frances Yates in her seminal work on *The Art of Memory* shed contemporary light on the long-forgotten, still, highly effective rhetorical method of remembering texts. *Ars memorativa* was a space- and image-based semi-conventional procedure speakers used in the ancient Athenian culture to be able to select and disseminate vivid ideas. Debra Hawhee has just published her second book (*Tooth and Claw*) on how much classical rhetorical practice was bound with the bodily. She, systematically revisiting Greek and Latin texts offers a bright new horizon for finding a new position for rhetorical literacy. These are just a few instances from the less than numerous investigations which can prove that there are pathways to be followed that lead us back to a deeper, a visually-sensually enriched rhetoric.

Rhetoric as a primordial power calls for a different definition from the ones that we have been administered so far, concentrating on the formation of suasive, verbal texts. George Kennedy, translator of Aristotle's *Rhetoric*, provides us with the basis for this non-mainstream rationale, arguing, that "Rhetoric, in the most general

sense, can be regarded as a form of mental or emotional energy imparted to a communication to affect a situation in the interest of the speaker. ... So understood, rhetoric is a feature of all human communication..." If rhetoric is a form of energy – that is, a primordial, creative force – then any kind of signs and signals can be included into the rhetorical encounter, for any forms of expression can be infused with such an energy. As a matter of fact, encounters do not exclusively start with verbal exchanges. Indeed, there is more than the word if the origins of rhetoric are considered. Rhetoric was originally about both bodily and discursive expressions of the compound self. The task of the rhetorical practice was to pair the visible with the articulable. Feeling and sensation were salient, seeing and telling were mutually constitutive in expression. If we go a bit further into the origins of rhetoric, accepting that it had a more holistic role and reference than that of the persuasive verbal act, we find a lot of traces of the visual within rhetorical theory. I have already mentioned the *art of memory* but there are also rich descriptions of *phantasia*, the inner sense of the speaker and the receiver, that connects imagination, cogitation and memory, *ingenium*, the creative force in meeting, cognizing and expressing the world, *energeia*, the energizing force that guide speakers to create vivid descriptions and to make their audiences to picture what is said in order to persuade or *ekphra-*

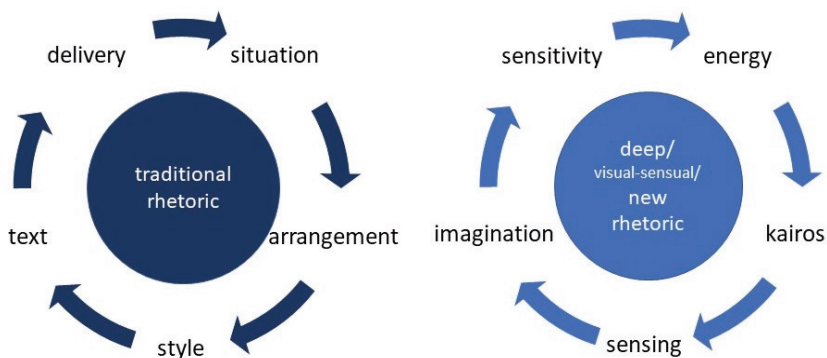


Figure 1

sis, the rhetorical description that unfolds before the audience's eyes, among others. Rhetoric then can be seen as a highly image-based, image-evoking source and mode of communication, conveying vivid messages that energize viewers' and listeners' senses.

This rhetoric has a sensual character the declaration of which needs the reconsideration of the terminology rhetoric is most often described by. So, in place of the traditional rhetorical canon we shall build a theoretical frame that includes energy, sensing, imagery, *kairos* and sensitivity (Figure 1), embracing a novel concept. A concept of the primordial power of human communication: a new rhetoric that reaches back the to the origins.

Anna Somfai

Visual Thinking: A Cognitive Reading of Codex Layouts

Introduction

Medieval codex layouts were complex designs planned with intended readership and specific purpose in mind. The present paper offers an insight into the archaeology of the mise-en-page from the point of view of its cognitive functions.

Medieval manuscripts being handwritten provided space for reshaping layouts, texts, images, reading and writing practices, and ideas. Texts were in each case copied from earlier manuscripts with an eye for accommodating the changing demands of readers and with the aim to best transmit and organize a body of knowledge.

The Structure of the Folio: Cognitive Implications of Planning the Layout

Folio layouts were mentally designed; then the concept was transferred on the physical folio. Ruling a blank page meant marking up empty space for entering texts and images in a specific manner. The process involved visual and cognitive choices as well as aesthetic considerations. Double horizontal and vertical lines served as the main text frame and also as a simple form of decoration (Figure 1).

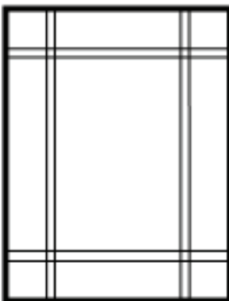


Figure 1: Double-line ruling for the frame of the main text. Basic decorative element. (The drawings in this paper are my own.)

Horizontal lines of the textual space helped to write faster and to produce straight lines of writing. Ruling was usually omitted for aesthetic reasons where larger illuminated initials and images were planned. When gloss was anticipated the marginal space was also ruled, with narrower line spacing for smaller letters akin to the modern use of double and single space (Figure 2).

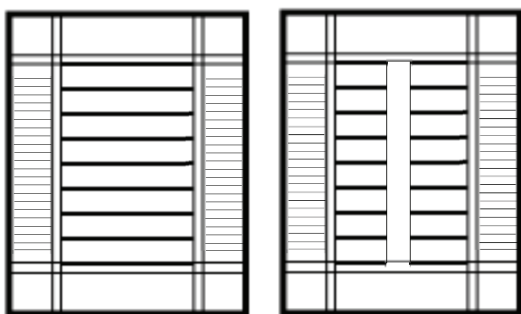


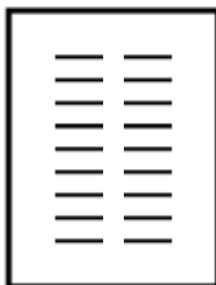
Figure 2: Ruling for main text and gloss: double space for main text, single space for gloss.

The two basic designs for ruling for text were long lines (Figure 3) and columns (Figure 4). Medieval scribes at different times

Figure 3: Basic layout design: long lines.



Figure 4: Basic layout design: columns.



made different choices depending on the book genres and based on experience. Eyes move in saccades, thus columns, being narrow, allow faster reading. Column design was used for instance for 13th-century university textbooks where large amount of reading was expected. In addition to the main text space, the margins were also ruled for additional, even narrower multiple columns to enter marginal gloss (Figure 5). Devotional books of the time had long lines with

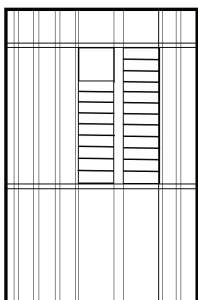


Figure 5: Layout of a 13th-century University textbook of Aristotle. Schema based on London British Library Harley MS 3487.

the text punctuated with colourful images, large initials, and their borders were illuminated with vegetation and various scenes involving human and animal figures (Figure 6). While the first design elicited

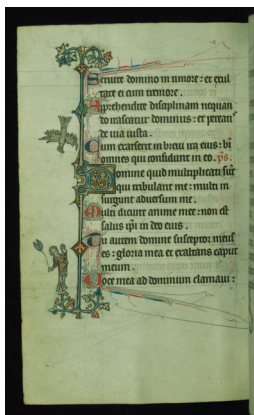


Figure 6: Devotional book. Fieschi Psalter. Walters Art Museum MS 45, fol. 17v (13th c.). Digital image courtesy of the Creative Commons license.

thinking, note-taking, and discussion and inspired an environment of teaching and learning, the second invited meditation and emotional response with slower pace of intermittent reading done in solitude. Texts copied a number of times over the span of several centuries

often show variations in layout, level of decoration and glossing techniques, testifying to changing attitudes.

Special layouts were developed over time in response to the demands of individual texts and genres. The canon tables listing the parallel loci of the four Gospels were arranged in four columns in an architectural setting, visually emphasizing the correspondence of the passages (Figure 7). Manuscripts of Euclid's *Elements* were often de-



Figure 7: Canon table. Freising Gospels. Walters Art Museum MS 4, fol. 24r (9th c.). Digital image courtesy of the Creative Commons license.

signed in a two-column structure with diagrams placed on the left-hand side and their explanatory texts on the right, moving visually from left to right thus from proof to explanation but also allowing the eye to run in either column from top to bottom, following literally a different direction of thought. Averroes' commentaries to Aristotle's works were sometimes written in a visually inescapable manner intertwined with Aristotle's text within the main text frame, but in smaller letters and single-spaced for instantaneous recognition.

Devices of Division: Zooming in on Details

While ruling provided the main framework for arranging texts and images, visual devices facilitated quicker orientation within the volume and on each page. Headers allowed readers to find a certain portion of the text while skipping others. Within the body of the text titles were often entered in red ink catching the eyes instantly (Figure 8).

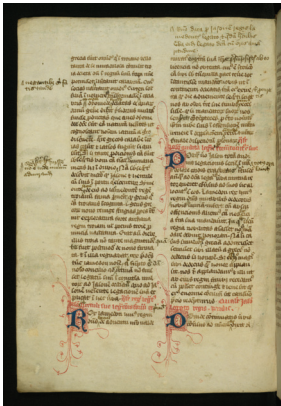


Figure 8: Use of rubrum. Guido delle Colonne, *History of the destruction of Troy*. Walters Art Museum MS 81, fol. 4v (14th c.). Digital image courtesy of the Creative Commons license.

Medieval scripts have changed over time and some of the early ones were used later for writing titles or first lines, a practice similar to our use of different fonts and styles within the same page (Figure 9).

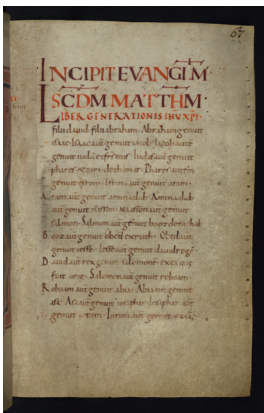


Figure 9: Use of different scripts. *Incipit and title in capitalis quadrata and capitalis rustica, text in Carolingian minuscule*. Walters Art Museum MS 4, fol. 34r (9th c.). Digital image courtesy of the Creative Commons license.

The text was visually mapped up throughout to facilitate easy navigation and quicker but deeper reading. A hierarchy of initials was introduced ranging from large, many-line illuminated initials through levels of smaller initials, differentiated by size and colour complexity, to small initials in blue or red or in the ink used for the text (Figure 10). Paragraph marks, sometimes in colour, were inserted to divide the text into units of thought. Punctuation marks indicated pauses based on further analysis of meaning at an even finer level. While titles and initials which resulted from canonized divisions

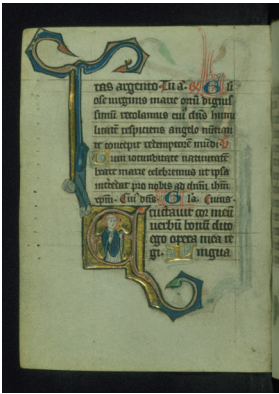


Figure 10: Hierarchy of initials. *Book of Hours. Walters Art Museum MS 37, fol. 15r (1300-1320)*. Digital image courtesy of the Creative Commons license.

for books and chapters had constant places, paragraph marks and punctuation focused on the precise meaning of briefer sections and marked a pause in reading and thinking, thus they changed location matching the interpretation of individual scribes and readers. Various helpful pointers were added in the margins by the scribe and by later readers, such as chapter numbers, source marks, and symbols interrelating different texts within the manuscripts (Figure 11). These devices allowed the reader to browse the text, skim read it and skip sections to focus on others or provided further information as do today's footnotes.

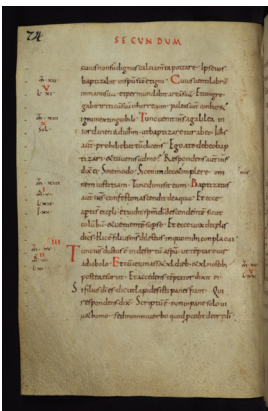


Figure 11: Marginal cross references. *Walters Art Museum MS 4, fol. 37v (9th c.)*. Digital image courtesy of the Creative Commons license.

Not all manuscript layouts were structured with an array of visual devices. Yet when lines were running with no pause visible at a glance, a closer look reveals division of a different kind, one that is

now taken for granted nevertheless took time to develop. By the 11th century the late ancient *scriptura continua*, text running with no space between words, gave place to the practice of word separation which helped readers of vernacular native languages to avoid vocalization while reading silently. This development contributed to smoother and faster reading at a more elementary level while also making the further divisions possible.

Engaging with the Folio: The Ongoing Discourse

Exploring texts through studying them in manuscripts prepared in this manner trained the mind to treat the folio as a personalized writing surface and to experiment with one's own ideas. Readers continued the interpretation of the main text and previous gloss by adding their own textual and visual gloss engaging both intellectually and physically with what lay before them. Words highlighting the content



Figure 12: *Gloss. Aristotle. Walters Art Museum MS 66, fol. 1r (13th c.). Digital image courtesy of the Creative Commons license.*

of a section, *nota* signs and pointing hands as well as longer comments on specific points accumulated in the margins (Figure 12). Thinking processes were made visually apparent as mental images were transformed into visual ones and textual analyses appeared in the marginal and interlinear space. These further additions by later readers introduced a new element in the reading of texts and images, that of continued and open-ended communication. Space thus facili-

tated discourse over time producing a visually manifest reception history.

Some of the explanations took the form of visual thinking, literally decomposing diagrams in an effort to explain details of their structure and function. Sometimes, where space allowed, decomposed

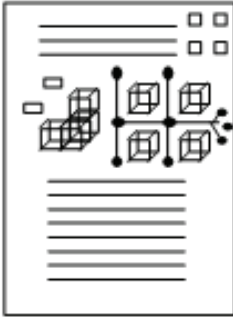


Figure 13: Brussels Bibliothèque Royal MS 9625-9626, fol. 13r page layout. Main diagram is explored by decomposing into cubes then further into squares placed within the main text frame and in the margin with explicatory texts in the squares.

elements and additional diagrams were squeezed around diagrams within the main text (Figure 13), at other times they were placed in

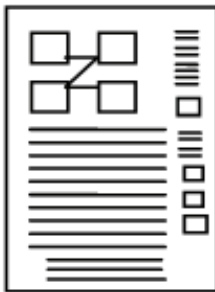


Figure 14: Brussels Bibliothèque Royal MS 9625-9626, fol. 12r page layout. Main diagram is decomposed into squares which are placed in the margin with explicatory text inside.

the margin (Figure 14). Such instances closely mirror the cognitive processes of the medieval annotator readers.

Conclusions

Navigating through the medieval mise-en-page and adding one's own mark was a voyage that aided the discovery of meaning, the speed with which one accomplished this goal, or when that was called for,

it guided one through the inner process of meditative reading. The personalized folios look much like the personal notebooks and manuscripts of modern authors. The practice of open-ended organization of knowledge, the visual nature of presentation, and the cognitive pointers visually underscore the similarities between medieval manuscript layouts and today's websites.

Irma Puškarević

Visualizing with Letters

Walking down the history lane there is evidence of text and image trying to overthrow one another. Beginning with Gutenberg's Galaxy, written text enjoyed the primary role. The emergence of photography brought upon us the next revolution and thus began the coexistence of humankind and images.

Forwarding to the current state of the communication environment, one cannot but wonder if there might exist other visual dimensions that are as successful in delivering meaning and influencing connotations, apart from photography. Some of the well-established ones are the illustration and moving images. However, the desktop era revolutionized yet again the design of information. It brought about the democratization of the visual, or if you'd like, the graphic elements, principally that of typography and typeface design. Democratization of typography enabled everybody with a computer to use typefaces and construct them, without prior knowledge. This phenomenon is among us today as well and the results are as positive as much as they are negative in a sense that they create various levels of visual and communication noise.

The goal of my chapter published in *Vision Fulfilled: The Victory of the Pictorial Turn (Perspectives on Visual Learning, vol. 1)*, was to argue that visual images are presently materialized also through the craft of typography and that visualizing content with letters can be done in a systematic and methodical way.

Letterforms, printed or on a screen, convey meaning and can be, for this reason, considered as a significant imagistic tool which is used in data visualization, product presentation, and, of course, education.

It is not enough to merely present comprehensive strings of thoughts and ideas with images. There needs to be developed a systematic set of skills for understanding the language of images (as it

was stated in the opening address of the 8th Budapest Visual Learning Conference, by László Lovász, President of the Hungarian Academy of Sciences, see the volume *Vision Fulfilled*). In this light, I would like to present conclusions from my experimental studies which can help us build skills for understanding the visual language of letters.

A world of thought became legible with moving type. A keen observation by one of the most influential typographers of the 20th century – Adrian Frutiger. Printed words on paper gave a visual dimension to language. And, the traditional quality of typefaces was durability and legibility. However, typographic tradition is constantly challenged due to technological advancements. Consequently, the durability has been recently replaced by elaborative letter stylization with a purpose of expressing additional meaning.

Typography, a medium of expression, constructs a meaning on the first level through the word image (meaning represented by a word itself) and on the second level through the typographic image (meaning is formed based on the holistic visual experience). Following this reasoning, we can expand on the idea that a typeface can become a signified. Furthermore, we can test the effects of the typeface's nuances, that is the effects of the levels of typeface complexity.

A useful playground for exploring this idea is the world of advertising because communication in advertising is intentional, as Barthes elaborates. Hence, the relationship between the art of typography and the discipline of rhetoric is enhanced.

After a series of empirical investigations, I drew these conclusions: (i) viewers consistently perceive typefaces to have different personalities, (ii) typefaces influence information processing, and (iii) certain typefaces are appropriate for certain communication contexts. Building upon these conclusions I was able to propose a systematic methodology of typeface effectiveness which began by defining two distinct sets of letterform properties, one being quantitative and the other qualitative.

Pursuing the quantitative aspect, I considered the letter matrix developed by Adrian Frutiger and the descriptive typeface classification by Catherine Dixon. The core principle of this aspect was to generate the letter skeleton using Frutiger's matrix and pair it up with Dixon's descriptive categories of letterform's formal attributes. These formal attributes carry descriptions about the letterform, such as serif detailing, stroke contrast, type of construction, etc. Letterforms treated in this manner become tools which can be objectively measured.

Considering the qualitative aspect of the framework, I called upon the principles of rhetoric, or more closely, since we are navigating through the scope of visual dimensions, upon those of visual rhetoric. The resources of the traditional system of rhetorical speech cannot be systematically re-interpreted to serve visual rhetoric, as Prof. Aczél points out. What is needed is to build a conceptualization of rhetoric that will answer to the challenges of the visual image. However, it is very much possible to borrow communicative, symbolic and strategic characteristics from that ancient discipline.

In line with the foregoing, I have used the conceptual taxonomy of rhetorical figures developed by McQuarrie and Mick. Their concept divides figuration according to the regularity or irregularity of the form. The gradient of form's deviation as they explicate it is directly applicable to the construction of various levels of letterform complexity. Going back to the quantitative aspect – once the skeleton of a letter is generated, it becomes a starting point for gradually building letterforms with various complexities.

The notion of the gradient of form's deviation can be further supplemented by visual rhetoric and semiotic resources. Here, I considered Prof. Aczél's views on visual rhetorical interpretation which are twofold. The first perspective addressed memory and the second focuses on what might be seen as metaphoric characteristics. Semiotic resources also address metaphor, as well as meaning-making through connotation. All these resources combined provide a diverse pool of micro-constructs based on stored mental images or "import" of signs in a specific domain where the meaning is formed on the grounds of associations and the like.

To conclude:

Letterforms are embedded in our daily surroundings and typefaces are design systems that help us get through the day. The majority of the population is accustomed to using system fonts when writing an e-mail, preparing a presentation or lecture. However, using typography and visualizing meaningful content with letters, *as comfortably as using images*, has yet to become a reality.

The conceptual proposition offered through this presentation is hoped to provide an insight as to how letterforms can be used as visual resources for data presentation and education. The proposition addresses both qualitative and quantitative aspects of letter construction and, consequently, the meaning it embodies. If these two aspects of typeface properties are combined, we are leaning toward a more systematic approach to visualizing verbal content. To further strengthen my argument, I humbly provide a possible solution to a potential communication problem by proposing an online platform (i.e. online

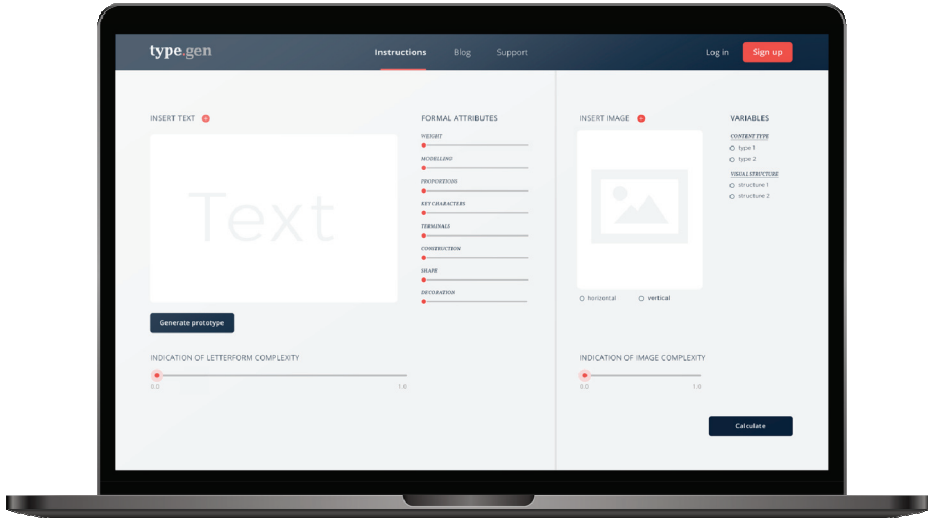


Figure 1

tool, see Figure 1) that will enable users to construct letterforms based on the level of expressiveness one wishes to make. This online tool would use letter skeleton as a starting point, the formal attributes for meaning construction then perceived as the typographic image, with visual and semiotic resources guiding interpretations of constructed forms.

When paired with technological resources, letterforms result in amplification of possibilities for manipulating functional and aesthetic properties of typefaces. And technological resources are developing in rapid pace. We are yet to see what new possibilities are stored for us in the future. If we develop and implement a structural framework for visualization through letters, we might just be ready to rush ahead with new challenges.

Andrea Kárpáti

Bauhaus Pedagogy: The Origins of Design Thinking

Design Thinking is a contemporary model for effective problem solving in a wide range of fields, from art and design through business to industry. Originally conceived at the Design School of Stanford University as a methodology to facilitate the process of product and service design, it spread around the globe and became a leading model for visual learning. In this presentation, we intend to propose a link between Design Thinking and the pedagogical theory and practices of the *German school of arts, crafts and architecture*, the *Staatliches Bauhaus*, founded 100 years ago, in 1919, in Weimar, Germany, and dissolved in 1933 in Berlin. During its relatively short period of existence, many of the most innovative artists, architects and designers joined its faculty, and developed a series of teaching programs as well as learning aids and manuals that have a lasting effect on art education.

Design Thinking and Bauhaus Pedagogy

Design Thinking offers a systematic problem solving approach for all aspects of life where new ideas are needed for a product or service. It combines elements of scientific research with industrial modelling and prototyping in search of a useful and (relatively) easy to manufacture product, market search from business and the aesthetic considerations of art and design. Traditional artistic, scientific and engineering approaches work in synergy. They are used to address a planning task from multiple viewpoints ranging from user needs through technical solvability to compliance with contemporary visual language. It is the user-oriented approach and continuous *dialogue between designers, producers, marketers and users* that makes the model popular and widely applicable. “Design Thinkers step into the end

users' shoes – not only interviewing them, but also carefully observing their behaviours. Solutions and ideas are concretized and communicated in the form of prototypes as early as possible, so that potential users can test them and provide feedback – long before the completion or launch. In this way, Design Thinking generates practical results” – postulates the summary on the front page of the major distributing platform of the model, bearing the name of its conceiver: the Hasso Plattner Institute (Figure 1).

Design Thinking creates practical results

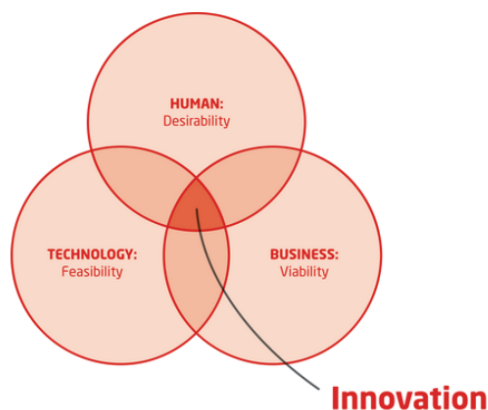


Figure 1: Design Thinking for innovation. Source, with description of the model: Hasso Plattner Institute, <https://hpi-academy.de/en/design-thinking/what-is-design-thinking.html>.

In most previous models, problem-solving starts with the explanation of the task by the commissioner of the product, followed by a brainstorming about possible solutions. Here, however, the first phase is called *Empathize* – a phase that requires a deep understanding of the emotions, ideas and needs of future users through research on previous, similar products or services, on-site observation and interviews. In the second phase, *Define*, we may thus formulate the task description rooted in user needs. *Ideation* or brainstorming come only after these user-oriented phases. The *Prototype* is, according to Design Thinkers, just a “thought draft”, the best idea

emerging from previous work that will be fed back in the *Test* phase to users to ensure acceptability (Figure 2).

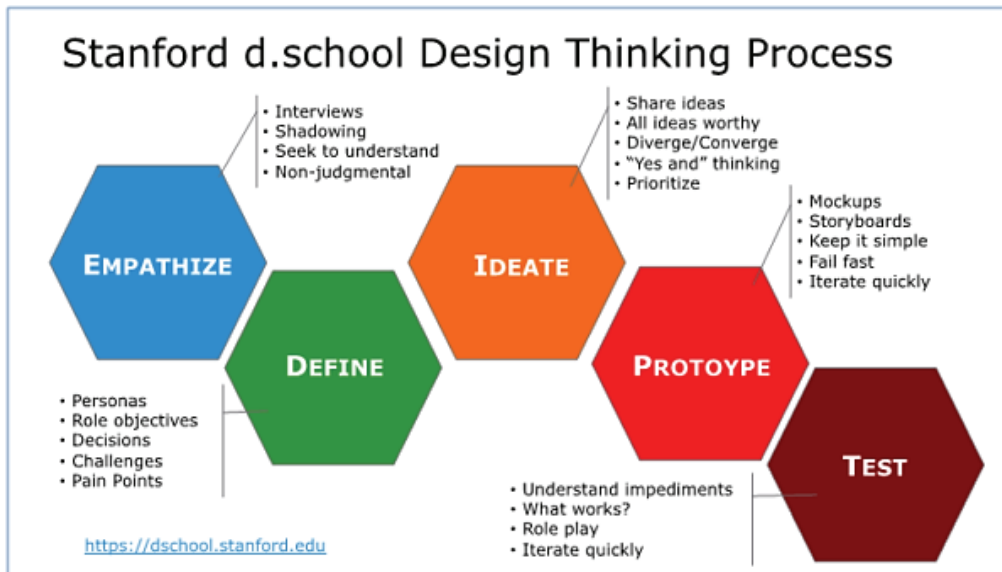


Figure 2: Phases of the Design Thinking process, with emphasis on the beginning. Source: David Terrar, “What is design thinking?” Enterprise Irregulars blog, 2018, <https://www.enterpriseirregulars.com/125085/what-is-design-thinking/>.

If the test fails, team members should handle it as a situation often encountered in science and industry laboratories. Reasons for a failure vary: either empathy was inadequate, or definition vague, or else, not the best idea from brainstorming made its way to prototyping. In any case, the whole process must be repeated with more self-reflection and scrutiny. As the activities related to these thinking processes are mostly visual, we propose to consider Design Thinking an exciting new model for visual learning. We will discuss phases of the problem solving process the Design Thinking model proposes in more detail in a further section of the presentation, where we will demonstrate, through classic Bauhaus design objects, how they are connected with Bauhaus pedagogy and contemporary art education.

Bauhaus, the revolutionary design school of the early 20th century has similar objectives to those of the equally ground-breaking design school of Stanford, formulated as the Design Thinking model a little less than hundred years later. In his Manifesto, the mission statement of the school conceived in 1919, Walter Gropius declared the central objective: *to move away from art as pure aesthetics and return to the technical reality of crafts*. “The art schools ... must return to the workshop. This world of mere drawing and painting of draughtsmen and applied artists must at long last become a world that builds. When a young person who senses within himself a love for creative endeavour begins his career, as in the past, by learning a trade, the unproductive ‘artist’ will no longer be condemned to the imperfect practice of art because his skill is now preserved in craftsmanship, where he may achieve excellence. Architects, sculptors, painters – we all must return to craftsmanship!”

Three years after opening the doors of the Bauhaus, in 1922, Gropius published a conceptual diagram about the structure of teaching. The programme places “building” (in German: *Bau*, the first syllable of the name of the school) at the centre of all the activities. However, a regular course in architecture was only introduced at the Bauhaus in 1927. Only the most talented students were admitted to this study programme. At start, they attended the Preliminary Course, a year of basic training in which they were invited to experiment with colour, shape and materials with no utilitarian goal in mind. This study of physical, functional and aesthetic characteristics of materials was followed by practical work in the workshops and theoretical studies: mathematics, physics of materials and history of cultures (Figure 3).

At the Bauhaus, artists and architects (the so-called “form masters”) worked together with the “work masters”, the craftsmen. Future artists, craftsmen and architects worked mostly in multidisciplinary teams to realize tasks developed by Johannes Itten, the founder of the course and its successors, László Moholy-Nagy and Josef Albers (cf. Figures 4–5). Exercises on construction, balance and appropriate use of materials enhanced both visual thinking and creativity. Paul Klee and Wassily Kandinsky conceived the curricula on

form and colour theory, George Kepes introduced experiments with light, Oskar Schlemmer taught about the analysis and depiction of the

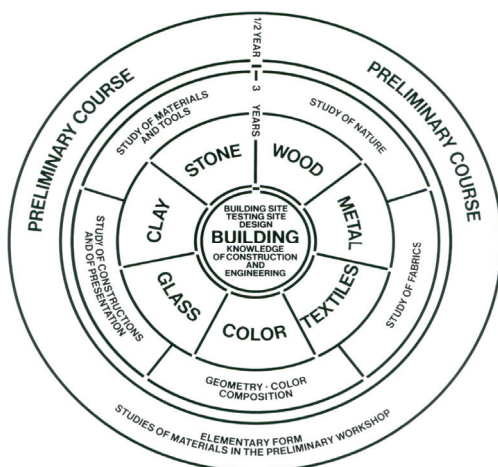


Figure 3: Walter Gropius, Circle diagram of the Bauhaus curriculum. Weimar: Staatliches Bauhaus, 1922. Source: *Das Bauhaus Kreisdiagramm*. Photo: Oliver Tomas. Lomography blog, <https://www.lomography.de/magazine/192550-das-bauhaus-kreisdiagramm>.

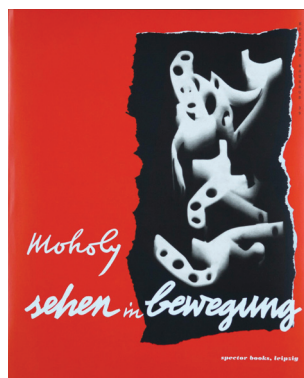
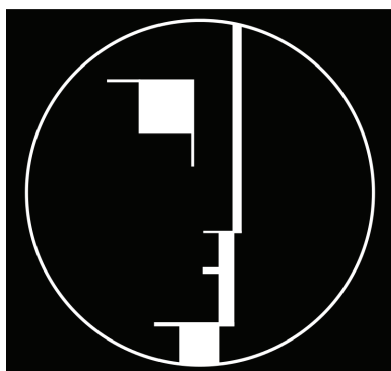


Figure 4 (left): The Bauhaus emblem. Source: <https://en.wikipedia.org/wiki/Bauhaus#/media/File:Bauhaus-Signet.svg>.

Figure 5 (right): László Moholy-Nagy, *Sehen in Bewegung* (*Vision in Motion*), title page. *Bauhaus Bücher* (Bauhaus Books series), No. 39, Dessau, 1938. Source: Spectorbooks Publishers, <http://spectorbooks.com/de/sehen-in-bewegung>.

human body and, to deepen this knowledge, invented Bauhaus ballet, a synergy of painting, sculpture, dance and theatre (Figures 6–7). After the preliminary course, over the next three years, students were encouraged to experiment in many media, and only after this formation in the fundamentals were the best students allowed to enter the core architecture course (which wasn't established until 1927).

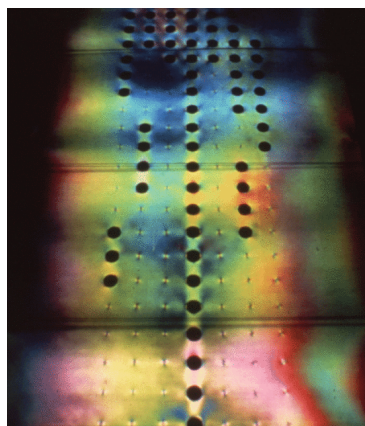
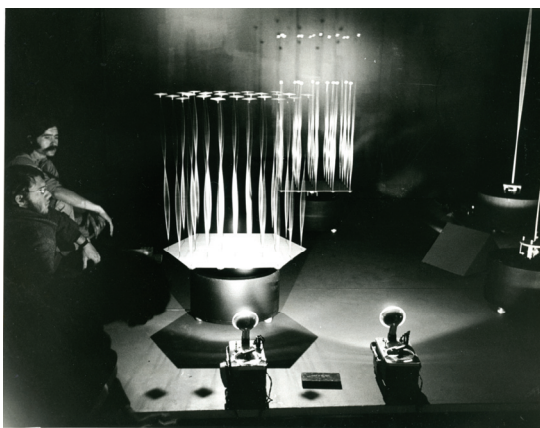


Figure 6 (left): George (György) Kepes and students, Discovery, light installation, 1970, Hayden Gallery, Massachusetts Institute of Technology. The young Kepes, painter, photographer, designer, educator, art theorist, was the assistant of Gropius at the Bauhaus. At the MIT, he founded the Centre for Advanced Visual Studies, a creative space of scientific experimentations for aesthetic purposes. Source: MIT News, <http://news.mit.edu/2018/mit-new-digital-archive-showcases-work-center-advanced-visual-studies-0222>.

Figure 7 (right): George (György) Kepes and William Wainwright, Photoelastic walk, light installation, 1969. Source: Art and Education blog, May 2018, <https://www.artandeducation.net/announcements/176565/50th-anniversary-of-the-center-for-advanced-visual-studies>.

In the following, we will illustrate how the ideas of Design Thinking are related to Bauhaus pedagogy. Figure 8 reminds us of the phases of the model and their sequence.

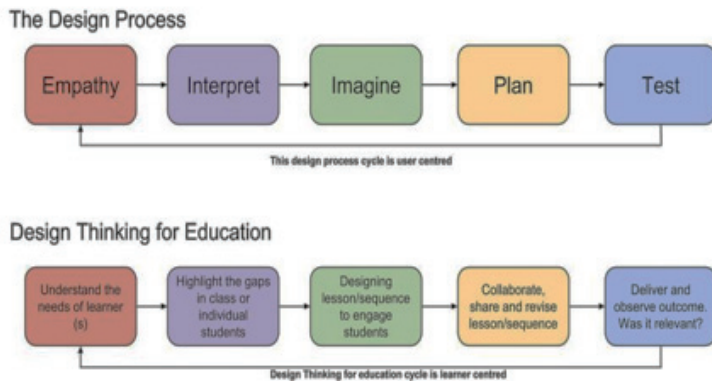


Figure 8: Translation of the steps of Design Thinking, a user- or client-centred model, to learner-centred art education. Source: Entry in the Roaming Educator blog by Christopher Lister, 2014, <https://christopherlister.ca/assessment/does-design-thinking-have-a-place-in-education/>.

Empathize

Empathizing with the owner of the problem that we intend to solve is the initial phase of Design Thinking, and also a core aspect of the planning procedure at the Bauhaus. Observing the life of a client for whom a house is designed or a chair is made, engaging with his or her views and immersing in the culture of the prospective user's existence inspired Bauhaus masters to include acting and dance in their curriculum. Theatre, ballet and opera performances by students and masters were meant to study human emotions in different situations, and to observe the interactions of the human body and its environment (Figure 9).

Define

The next step in Design Thinking involves defining a problem through translating the findings of the Empathy phase into needs and insights. Assuming new viewpoints and creating a unique design vision with a problem statement that may give rise to multiple design

solutions was a key activity in all workshops of the Bauhaus as well (Figure 10).



Figure 9: Actors of the Triadic Ballet (1922) at the Bauhaus.

*Source: Getty Images and Artnet News blog, 2019,
<https://news.artnet.com/exhibitions/triadic-ballet-bauhaus-1444630>.*



Figure 10: The logo of the Bauhaus: three basic colours and geometric forms to express the purity and scientific orientation of the art school.

Sources: on the left: SH Design blog entry, <http://shhdesign.co.uk/blog/the-use-of-basic-shapes-and-colour-in-design-the-influence-of-the-bauhaus/>.

On the right: Silver chain, made of Bauhaus basic forms. Sugartrends, <https://www.sugartrends.com/en/silver-chain-bauhaus-basic-forms>.

Ideate

Ideating means going wild: exploring a wide solution space and finding radical design alternatives. This phase of design thinking grasps the essence of Bauhaus ideology: breaking away from the general conceptions of “appropriate housing” or “comfortable furniture” and produce solutions that reshaped more than a range of objects – it generated new lifestyle trends (Figure 11).

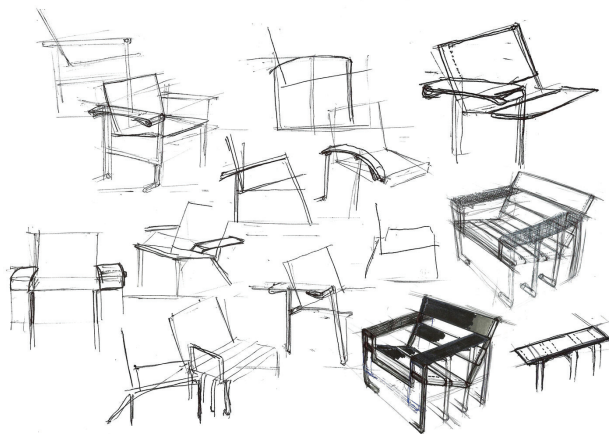


Figure 11: Marcel Breuer, Designs for the Wassily club chair. Innovative design involved a lightweight, easily movable structure, observable using minimum upholstery and the first ever chair with a bent-steel frame.

Prototype

A key phase in Design Thinking is to prepare a prototype to show the client the design idea in a visual form that engages multiple sensory modes. A prototype can be anything – post-its with inspiring quotes, a role play and of course the newly designed object. The “Bauhaus lamp” embodies an essential Bauhaus idea: form follows function, in a modern synthesis of fine and applied arts. Moholy-Nagy’s metal workshop promoted the use of new materials and favoured mass production under a collaborative, rather than individual, approach. Collaborative prototyping was an essential part of workshop activ-

ities for the student groups, as they needed to show their ideas in shareable forms for peer and teacher review (Figure 12).



Figure 12: Wilhelm Wagenfeld, Carl Jakob Jucker, Table lamp, 1924. Simple geometric shapes: a circular base, cylindrical shaft, and spherical shade ensure maximum simplicity and greatest economy. Source: Bauhaus-Archiv, Berlin, https://www.bauhaus.de/en/bauhaus-archiv/3_sammlungsbestaende/8_werke/.

Test

Testing, the last and perhaps most crucial phase of Design Thinking, was highly important for the Bauhaus workshops, too. They aimed much higher than teaching to design marketable products: they wanted to change lifestyles and tastes of their customers. When the new club chair hit the market, the radically new concept for the epitome of cosiness at exclusive gentlemen's clubs elicited controversial reactions, but finally, the new design was accepted (Figure 13).

The legacy of the Bauhaus masters is a living tradition at Hungarian art and design academies and in the training of architects. The name of László Moholy-Nagy in the title of the art curriculum of the Visual Culture Research Group of the Hungarian Academy of Sciences, “Moholy-Nagy Visual Modules – teaching the visual language of the 21st century”, refers to this important and, for public education, still unutilized heritage of Hungarian art education: the educational theories and practices of its Hungarian masters: Marcel Breuer, György (Georg) Kepes and László Moholy-Nagy. Their ped-

agogy involves a communicative, practice-oriented use of the visual language, collaborative creation and synergy of art, design and industry: practical applications of creative ideas. They introduced contemporary technologies, experimented with solarization, and introduced

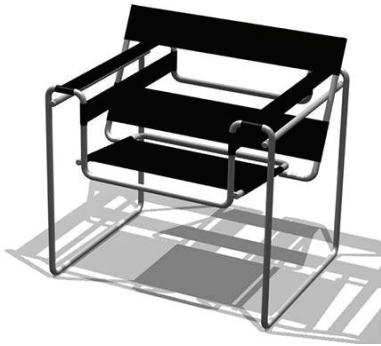


Figure 13: on the left, Marcel Breuer: Wassily chair, 1925–1926. Source: https://cdn.shopify.com/s/files/1/0042/2782/products/chairs-marcel-breuer-wassily-chair-1_large.jpeg?v=1546005546.

On the right, Jean Moulin: Leather Lounge Chairs, c. 1920. Source: S16 Home, <https://s16home.com/products/leather-club-chair-c-1920>.

*See the explanation of Design Thinking phases here: Hasso Plattner, ed., *Design Thinking Bootleg*, Stanford: Stanford University, School of Art and Design – Institute of Design, 2008, <https://dschool.stanford.edu/resources/design-thinking-bootleg>.*

creative task sequences for the in-depth, aesthetic and scientific study of materials – methods that are important and relevant today.

The Design Thinking model, integrated with Bauhaus pedagogy, is a new and promising path for art education. Our discipline is integrative, as it supports the acquisition of disciplines in science or liberal arts through visualizations that provide new insights through explaining relations, connections and processes.

Péter Neuman

The Victory of the Visual Approach in Abstract Physical Theory

I am quite sure that there are some in the audience, and not only physicists, who looking at the title immediately know what this talk is going to be about: Feynman diagrams. Indeed, the powerful and “easy to use” visual tool introduced by Richard Feynman in 1948 in order to tame quantum field theory is the topic of this short presentation. But why do we need to domesticate a physical theory? What does this amount to? Well, it can mean different things. First of all, quantum field theory is difficult to learn, even more difficult to make calculations within its framework. You can easily verify this if you ask a graduate student of physics the day before her final exam. The visual, diagrammatic approach presented at the huge Pennsylvania inn some 70 years ago in front of a carefully picked few colleagues, not only makes the life of the graduate students easier by simplifying the way we derive certain formulae, but as some researchers claim are absolutely inevitable to be able to get results.

The development of quantum field theories, the quantum theories of fields (e.g. electromagnetic field) was one of the most important achievements of theoretical physics in the 20th century. It is quantum field theories that help us understand the peculiar behaviour of light, the existence of photons, the light quanta, that may look corpuscular and wave-like excitations of something, a minute later. There are several field theories, explaining the behaviour of elementary particles. Contrary to Feynman’s own widely advertised pragmatic ambitions, most of us would like to hope that field theories do not only describe the behaviour, but also tell us what the microscopic world really is. Quantum field theory as far as agreement with experimental results are concerned, is one or may be *the* most successful physical theories/theory.

For the sake of the arguments presented below, it is sufficient to understand that the basic principles of quantum mechanics are applied to field theories in one way or another, thus we arrive at theories with enormous potential in explaining certain interactions in the microscopic world, especially at very high energies and short distances, i.e. in the regime where quantum effects become important. High energy particles are also fast. If their velocity gets close to the speed of light, we must modify the approach in order to be in agreement with the theory of relativity, which makes the already difficult calculations even more demanding. So much demanding in fact, that Edward Witten, one of the founding fathers of string theory, another favourite playground of those who love lengthy calculations and formulae, referred to quantum field theory as the “the most difficult theory of modern physics”. The difficulties belong to two groups. One of them we have already mentioned, it is the tedious mathematical machinery needed to arrive at physical results, numbers, that we can compare with experimental results. These are relatively easy to overcome, all you need is a preferably large group of smart people suffering from insomnia. Graduate students of physics in some competitive schools will clearly belong to this group. The other type of difficulties arises because quantum field theory in some cases becomes ill defined. In other words, the results we get following the strict rules of mathematics simply do not make physical sense. For example, we calculate the energy of the vacuum in quantum electrodynamics, and we get infinity, which is a clear nonsense. There are techniques to get rid of these problems, however these techniques, especially in their original forms (proposed almost a century ago), take us out of the realm of exact mathematics, they are sometimes even ad hoc and impossible to explain in a comforting way.

Feynman diagrams provide a tool that in some cases solve both problem types. The diagrams look like particle trajectories with a well-defined set of rules that determine how these “trajectories” should be “translated” to formulae. The trick is that while the derivation of the formulae is far from intuitive, using the diagrams the process becomes intuitive, thus easy to render, draw and remember. Feynman diagrams really look like colliding particle trajectories,

and all this happens in quantum theory, where well defined particle trajectories do not exist, at least in the usual Copenhagen interpretation. The Copenhagen interpretation asserts that such physical attributes as position – necessary for a line-like trajectory to make sense – do not exist as long as we do not perform a measurement. And measurements are not performed during the collision, therefore we have very good reason to say that the trajectories in the Feynman diagrams are NOT the trajectories of the particles we are talking about. So what are they? The debate about the nature of Feynman diagrams has been going on for decades. Are they simply mnemonic tools aimed to help the lazy or the less gifted? Or, as Frank Wilczek put it: “The calculations that eventually got me a Nobel Prize in 2004 would have been literally unthinkable without Feynman diagrams, as would my calculations that established a route to production and observation of the Higgs particle.” (Frank Wilczek got the Nobel prize together with David K. Gross and H. David Politzer for the discovery of the phenomenon of asymptotic freedom, which was a very important step in the process of understanding strong interactions, responsible for holding the nuclei together.)

At this point we arrived at the very question of this talk: are Feynman diagrams necessary for performing the calculations that produce numbers in agreement with experimental results or not? In other words: do we learn fresh and new things about Nature with the help of Feynman diagrams? Fresh and new things we could not have learnt otherwise, from any other source.

There has been a widely debated issue that kept some philosophers of science busy in the last 50 years. The issue is about the epistemological status of *thought experiments*, and the question is exactly the same as the one about Feynman diagrams. Can thought experiments be replaced by a string of inferences formulated within the theory or do they amount to something more profound? Do they contain elements that were not already present in the theory before the thought experiment was proposed?

Instead of giving a correct definition here for thought experiments, I rely on the common understanding of the expression.

I would like to explain why I believe that Feynman diagrams can be perfect examples of thought experiments. The general recipe for creating thought experiments based on a certain theory is that we choose a particular experimental situation adopting the rules given by the theory, and generate the “thought experimental results”, which in some cases may contradict our or others’ original theoretical assumptions. The famous thought experiments of Galileo, for example, work this way. Feynman diagrams, as thought experiments, are based on the assumption that microscopic processes, normally described via quantum theory, can be thought of as interactions between fully classical particles. Classical particle trajectories and interactions can be visualized in classical ways, making an intuitive approach possible. The assumption is based on the mathematical formulation of certain quantum processes. The classical analogy is valid only from a certain point of view, and for a limited scope, therefore it does not imply that quantum ontology can be replaced by a classical one. However, for finding some specific results, as we understood from Wilczek, these thought experiments are necessary.

According to Wilczek, and according to what we saw in the physics of the past 70 years (a large amount of results were derived exclusively via Feynman diagrams), the diagrams are necessary. There is something more in them than visualization of the theory. In this respect, they are close to those thought experiments that tell us new facts about Nature, facts that cannot be seen without their help. Therefore, the case of the Feynman diagrams endorses those in the philosophical debate who claim that thought experiments are not merely inferences.

Rita Lisa Vella – Anna Chiara Sabatino

Virtual and Augmented Realities, Cinematic Experience: Urban Space 3.0

Introduction

The current world is overflowing with audio-visual stimuli, while the spatial experience is more and more structured by an intrusive mediatic system through multi-layered information, both geographical and coded.

Specifically, our cities are full of commercial screens and electronic devices, and surveillance cameras are always on. The media are reshaping the human experience developing different kinds of visuality and narratives. Cinema as a living medium, with hybridization of multiple narrative practices and media, has to be considered a relevant part of how urban contexts and its visual regime interact with audio-visual technologies used to represent and rebuild urban life and narratives.

The role of the new medial images in the urban context and, in particular, the contributions of these images to building and sharing specific urban narratives and identities are here investigated through audio-visual examples where urban storytelling is assumed to be the result of the dynamics in between the city, the users and the devices, that allow a contemporary experience of cinema in its latest modes of relocation, assemblage, expansion and performance.

The Medial Body of the City

The city is a privileged context to observe the diffused aesthetics or “hyperaesthetics” connected to the proliferation of medial images, and also to investigate the possibility of a corresponding process of

anesthetization as “a kind of numbness and the connected weakening of the ability to create our experience through the senses”.

All the images spreading through urban screens, mobile devices or social networks are in some way implicated into the process of building and sharing the meanings of the city and, as a consequence, of the identity of the city. So, we should refer to the aesthetic identity of the city as the whole set of expressive qualities represented *in* the city and *on* the city, where all the images are part of the city as a complex, cultural system.

Specifically, virtual reality (VR) and augmented reality (AR) technologies in the urban context allow users that visit cities to participate within the narrative structure and plot conceived for them. If AR is positioned between the real world and the virtual world, VR juxtaposes multimedia content (e.g. 3D models, animation, video, audio, and websites) on a real image captured by a video camera in real-time, whose activation depends on an object that triggers an action, usually for multimedia content interaction and visualization. In simple terms, Augmented Reality technology adds information about the image while maintaining the real view of the surroundings, Virtual Reality makes the user experience a world in a world that simulates the real.

Through the following practical cases, we investigate the applicability of a transmedia storytelling model for users that, visiting cities, may participate within the narrative structure and plot of virtual and augmented realities in urban contexts.

The Medial Body of Images

We can definitely say that nowadays cinema is in constant search of new environments and devices onto which to transfer itself, from city squares to my smartphone. Looking at relocated cinema experience as something that has moved to somewhere else from its original context, penetrating aspects and practices of everyday life, the spectator finds him/herself involved in transmedia storytelling environments while exploring urban space.

Bepart

Bepart is an Augmented Reality application that transforms the city into an exhibition space by adding an “invisible” layer every citizen can experience. In Figure 1 there is an example of Bepart using augmented reality, in which Mole Antonelliana becomes the head of a huge octopus through the addition of synthetic elements that appear to be part of the real world.

Three characteristics are activated by Augmented Reality techniques:

- The work of art becomes something that without the intervention of the user wouldn't appear/exist;
- the user can experience an “additional element”, multidimensional, alive, that isn't physically there;
- the user can experience the installation moving himself around it, with his own body.



Figure 1

Imageen Tarraco

This application allows the visitor of Tarragona and Costa Daurada an immersion into the Roman city of Tarraco through their mobile devices, that become windows to the past through which visitors can admire the greatness and original disposition of the monuments and old spots and get into the real environment of the era that they are visiting. Figure 2 shows an image from the Imageen Tarraco project. An example of virtual reality, that allows the users to immerse into the ancient Roman city of Tarraco through their mobile devices that literally become windows into the past.

Relocated cinema takes part in audio-visual virtual reality narratives, in which user coincides with spectator: looking at the scenes of a past living Tarraco, spectators navigate plot surface, not confronting an “other” world capable of speaking about the “real” world, but rather a “possible” world that can find its realization.



Figure 2

Both AR and VR realities use 3D techniques that “high definition” cinema is familiar with, a kind of visual language that, just like it happens in 3D movies, leads spectators immediately to the heart of the action.

But this user/spectator lives experiences so filled with stimulations that very low participation is required. Like hot media, AR and VR grant their users such a great wealth of perceptual intensity that no form of completion is needed.

In both Bepart and Imageen Tarraco the user meets high-definition body images through a “guided” tour either in the “past” virtual reality or in the present “augmented” city, going from a key point to another in a high-definition and perceived map designed just for her/him. While exploring the city, the user/spectator experiences these fragments of relocated cinema like a casual wanderer and observer of the urban context: without the urban user and his/her exploring” the effect would simply not occur.

Conclusions

The new body of medial images, travelling through a myriad of screens, changing our relationship with the city and urban space, make us live in emotional and narrative spaces, rather than just physical ones.

In contrast with high-definition ones, low-definition city narratives, built through collaborative processes that involve inhabitants and visitors, turn users/spectators into performers that don’t just attend the premade show, but collect and reshape pre-existent images and materials, creating their own meanings. Even though AR and VR in the urban space are conceived to involve the user as much as possible, they strictly frame her/his possibilities of experience, establishing boundaries within few possible practices and ways of use, not allowing the user/spectator to become a performer.

The described cases suggest that it is not just a matter of technology change, mobile screens for mobile spectators, but a matter of narrative and new forms of engagement with the urban stories. It is performative, because everything is taken within the flow of becoming: the user, who can keep doing whatever he wants while using the screens (i.e. walking, driving, speaking with other users); the screens/devices that are hybrid devices used for seeing, communicating, lo-

cating; the off-screen world that surrounds the screen and the user, that is not a dark silent room designed to disappear in favour of vision; the images on the screens, that are related to the mobility of the screen, the user and the off-screen world. All these elements are interconnected in a flexible and intimate way, co-participating in the breaking up and recomposing of urban meanings and narratives.

Visual Learning Lab Papers

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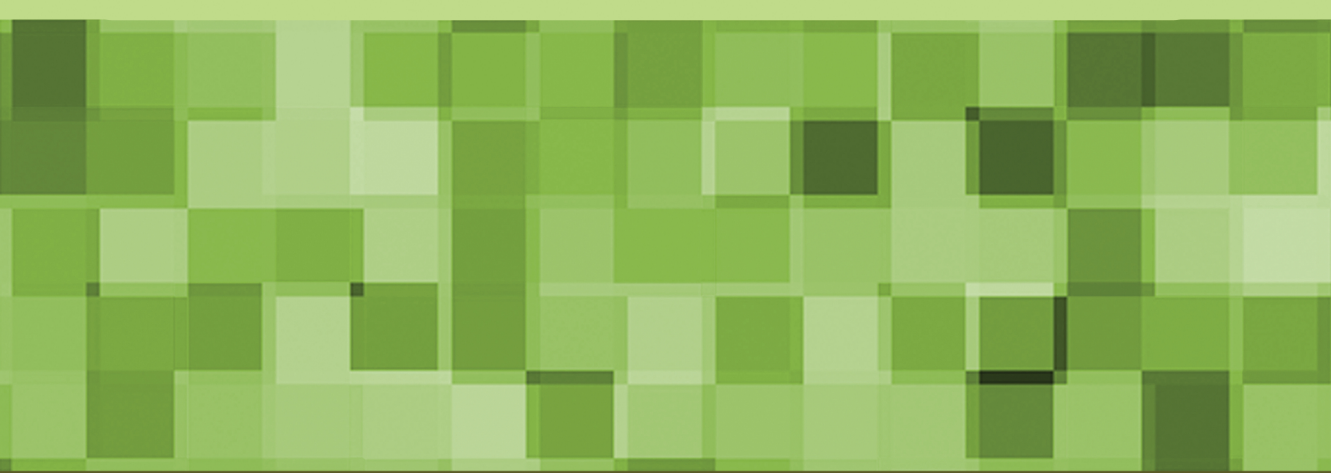
No. 9 (1/2019): Visual Learning – A Year After. Talks by András Benedek, Kristóf Nyíri, Petra Aczél, Anna Somfai, Irma Puškarević, Andrea Kárpáti, Péter Neuman, Rita Lisa Vella and Anna Chiara Sabatino.



Mission Statement of the Visual Learning Lab

Although we naturally think in both words and images, educational theory has focused overwhelmingly on the verbal dimensions of teaching and learning. This is in part a reflection of the rise of book printing: pictures receded into the background, even in spite of efforts by Comenius and others to integrate them into texts created for educational purposes. In today's networked digital environment, however, images are easy to access, and can be handled just as smoothly as words. In response to the new challenges hereby created, the Department of Technical Education in the Budapest University of Technology and Economics has established the Visual Learning Lab (VLL), with the goal of furthering the use of visual technologies – including film, video, and interactive digital media – in the teaching and learning process, and of engaging in high-level research on all aspects of visual education.

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