Interim Report 2018

Mixed Methods
in the Humanities
— funding initiative of the Volkswagen Foundation

New potentials
for analysing networked images
— research project

April 2017 – July 2018

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1 – Review

Since April 2017, regular weekly working meetings have taken place at methodological and content-related level between the qualitative-hermeneutic perspective (Janna Kienbaum) and the perspective of algorithmic computer processes and information visualization (Paul Heinicker). The content and organisational communication (topic preparation, literature, minutes, dates, etc.) within the team is recorded using a digital research logbook or a platform (*Notion*).

The working meetings were framed every two months by meetings with the entire project team, where the initial results of the image study and other content and organisational topics were discussed on an interdisciplinary basis. These meetings took place at the FH Potsdam, the University of Potsdam or the Potsdam Institute for Climate Impact Research.

The programme of the anci project included active participation in the DH discourse at conferences and workshops as well as our guest meetings with external scientists with whom we discussed current issues relating to the digital humanities and their methods. These also took place at regular intervals, e.g.:

09.17: Linda Walsh - visual rhetoric
11.17: Margarete Pratschke - digital art history
01.18. Peer Trilcke - digital literature analysis

In May 2018 we published our own **website** on the *anci* project on the web, which provides the presentation of the target project and the documentation of the first image study (horizon recognition) and its methodological reflection for free download.

interface.fh-potsdam.de/anci

documentation of the first case stuy (German):
interface.fh-potsdam.de/anci/pdf/horizontanalyse_anci.pdf

Between February and July 2018 Paul Heinicker left for a research stay at the Strelka Institute for Media, Architecture and Design in Moscow to sharpen his knowledge about method criticism. As a replacement, the graduate physicist Sonja Totz was hired via the Potsdam Institute for Climate Impact Research and Christopher Pietsch as Datavis engineer via the Potsdam University of Applied Sciences between February and July 2018. Both were concerned with our second image analysis of the temperature graphs and the so-called *hockeystick* as a striking image, which we started in February 2018: Sonja Totz provided the quantitative measurement of the image data and their analysis by programming specific algorithms (mainly with Computer Vision and Python), while Christopher Pietsch provided the collection and scraping of the images using the *anci miner* programmed by him as a tool.

The following quantitative tools were developed in total between May 2017 and July 2018:

- Scripts for context and image scraping
- Tool for horizon detection in images
- Natural Language Processing Algorithms for context analysis
- Development of the *anci miner* as a further development of the image craper
- Tool for climate paragraph recognition (e.g. color values, entropy, calculation of diagram formats, horizontal lines etc.)

The second, current image study, which we have been working on since February 2018, focuses on the analysis of digital graphs of exponential temperature curves such as the so-called hockey stick. We question the visual rhetoric of these iconic „striking images" or „striking motives" in the use of different social-political contexts, i.e. within the climate change communication of climate sceptics, scientific climate institutes, NGOs or specialist journals. Compared to the horizon study, the method design runs in reverse order in terms of the „explainatory design": Following John Creswell's Mixed Methods an initial quantitative image analysis based on computer vision and a neural network is followed by a qualitative deepening of the measurement results based on hypotheses derived from the quantitative analysis. The subsequent qualitative-hermeneutical analysis started in July 2018.

2 – Outlook

The results of our first and current image survey, the theoretical findings on visual digitality and the digital methods will be presented on 13 and 14 September 2018 at the workshop „Der digitale Blick. Mixed Methods in Image Analysis: Qantitative and Qualitative Approaches" at the ZEM (Centre for Media Studies). The workshop as a part of the *anci* research project unites guests from digital art history, but opens up thematically with regard to the overarching question of qualitative and quantitative data. Further information at: **http://www.zem-brandenburg.de/de/events. html#16_2018-09-13**

In addition, we are planning a two-day hackathon in November 2018: Questions about the cognitive value of similarities are to be applied experimentally to the field of climate images on the Internet. Together we want to test and discuss existing algorithms for the quantitative investigation of similarities; we also want to gain new insights into the roles images play between science, politics and culture in the case of climate change communication.

3 – Scientific results of the horizon line survey

First scientific results of the digital image analysis project anci were achieved by means of a first image study on the horizon line, which we carried out between July 2017 and January 2018: We questioned the photographic use or the either strikingly high and low position of the horizon line in digital landscape photographs (here exemplarily at the Polar Sea and the CO2 factories) and to what extent this visual rhetoric carries a social political or symbolic value with regard to climate change. Relating to the feasibility of the mixed method systematics, we oriented ourselves on the method design of „generalisation" or „exploration" according to John Creswell [1], in which a quantitative analysis follows a qualitative analysis. Qualitatively, the description and understanding of the interrelationships of the „deeply" collected data was carried out using a limited digital image corpus (here using „Pinterest" as a digital method) and through a structured and interpretative procedure, here based on Panofs-

1 – Cf. Creswell, John W. (2003): Qualitative, quantitative and mixed methods approaches, Thousand Oaks, Calif.: SAGE, P. 208-225.

ky's model of image perception and interpretation. The derived hypothesis and its qualitative hypothetical result – concerning the aesthetic properties of the digital horizon pictures, their contextualisation and their indexing within journals, the stricing horizon line seems to function as a formal and stylistic element of threat by climate change – have then been tested empirically and data-based for regularities.[2]

The complete study can be viewed and downloaded as documentation on our website:

interface.fh-potsdam.de/anci/pdf/horizontanaly-se_anci.pdf

We were able to record the following (compressed) results, which are also contained in this document.

3.1 Methodology

In view of the comprehensive qualitative analysis framework, the quantitative method could not be applied one-to-one to the art historical and image scientific analysis procedure.

Due to the need for formalisation or the necessary predictability of the object of analysis, the significance of the quantitative method is limited in its role as a generalising corrective. Above all, the technical measurement errors at the pictorial form level, for which the horizon line could not be correctly assigned despite the average effective CV algorithm, represent only insufficient „evidence" for the qualitative question with regard to the overall result in terms of content for the distribution of the horizon positions. The mere exclusion of faulty image data sets does not mean a representative and valuable handling of the qualitative result - to see the horizon function as a high dividing line as an expression of the threat of climate change. In addition, with regard to the strongly „tailored programming" of the horizon algorithm, it could only measure the „familiar horizon", but not the „natural horizon" of curved mountain ranges. An originally qualitative „why question", which referred

2 – Cf. Brinkmann, Hanna; Commare, Laura: „Warum 'Anything goes' der Goldstandard sein sollte – Überlegungen zu Methodentradition und empirischen Forschungsansätzen in den Kunstwissenschaften". In: Newest Art History – Wohin geht die jüngste Kunstgeschichte? Tagungsband der 18. Tagung des Verbandes österreichischer Kunsthistorikerinnen und Kunsthistoriker (2017), P. 169.

to the significantly high or low position of the horizon line in connection with the climate change context and a possible statement intention, thus became increasingly a „how question" in view of its parameterisation, which determined whether at all, at what height and how frequently the horizon line occurs using the example of the Polar Sea and CO2 images. The qualitative hypothesis according to which the horizon can be seen as a consciously set formal „control instrument" of perception in the form of a markedly high or low dividing line and thus as an expression of the threat of climate change is only partially supported by the quantitative measurement.[3]

The fact that the image study with the quantitative approach deviates so strongly from the actual question of content in favour of increasing methodological reflection and above all raises the problem of how qualitative but also quantitative questions can be formulated correctly in the digital humanities is the central result of the first image analysis on the horizon. So, the conclusion of our first image analysis essentially matters the role and the potential of the different (digital) methods rather than reliable information about climate change.

3.2 Content - Polar Sea Photography

• If the quantitative analysis is understood as a corrective or generalisation approach of the „deep" qualitative research results of Pinterest, the statement about the height of the horizon line in the Polar Sea photographs would have to be „corrected". If one believes the quantitative numerical values [4], the majority of the horizon lines (49.2%) are in the middle of the picture with an average height of 49.8%. The qualitative statement regarding the concisely highly settled horizon line and its dramatic rhetoric in the Polar Sea photographs would therefore have to be corrected „downwards", according to a horizon that provides for balance by a majority.
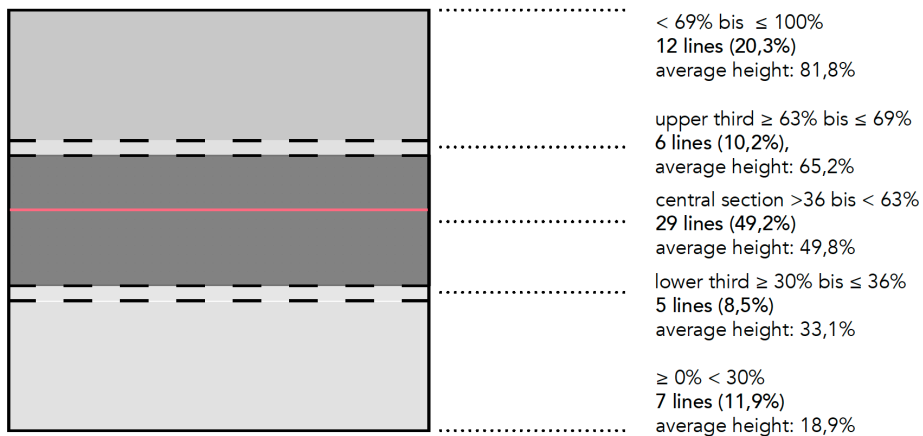
[3] – The output of the measurement is used for this result determination despite the „optimisation problems" and the inaccuracy from a qualitative perspective that occurred during the scraping process, computer vision and natural language processing (checking only the English data sets). In this way, an attempt is made to guarantee the „genuine" method of the quantitative method.

[4] – Apart from the fact that the 61 photographs are a very small image sample in terms of the quantitative, generalising claim, „manual" random samples of individual measurement results increasingly revealed incorrect information about the horizon position. The climate change context could not be quantitatively guaranteed for individual images.

• The interpretation according to the Pinterest collection (29 photographs as starting material) that the horizon in the Polar Sea scenes can be understood as a directed dividing line in the sense of a „time scarcity", a dystopian vision of the future or a „fear appeals" (Manzo) and a virtual crossing of the horizon with the upper picture surface in favor of the threatening climate change sequence - the vast sea surface with the melting ones, burst ice floes or the individual polar bear on the plaice - only little play leaves, would have to be relativized after the quantitative result from the measured 59 images of Google Image Search.

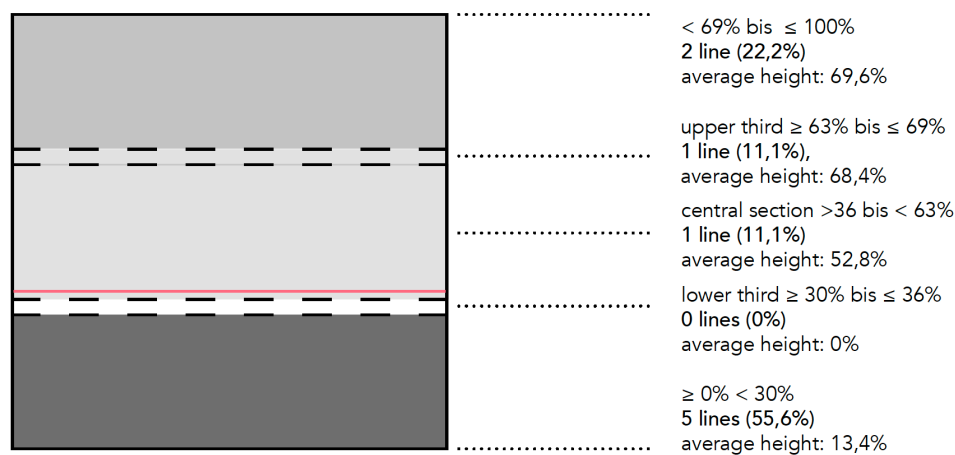polar sea 59 images 52,8% average height

< 69% bis ≤ 100%
12 lines (20,3%)
average height: 81,8%

upper third ≥ 63% bis ≤ 69%
6 lines (10,2%),
average height: 65,2%

central section >36 bis < 63%
29 lines (49,2%)
average height: 49,8%

lower third ≥ 30% bis ≤ 36%
5 lines (8,5%)
average height: 33,1%

≥ 0% < 30%
7 lines (11,9%)
average height: 18,9%

3.3 Content - Photographs of CO2 emissions

•　　The measurement result of the digital photographs on the subject of CO_2 emissions is questionable overall and seems to raise the problem of the extent to which, with such an extremely narrow image sample of only nine images, a mass of data to be processed quantitatively can be spoken of. If one strictly follows the output, the qualitatively determined formal similarity criterion of the horizon line, which is markedly deep here, could be confirmed by a majority: The average height of the horizon measured by Computer Vision is 36.4%, five of which have an

average height of 13.4%. This location corresponds approximately to the distribution of the qualitative image corpus, in which 16 of 28 images contain a horizon line in the lower quarter, fifth or even on the image edge.

• One advantage of the low output is that the CV and scraping results of the „context analysis" can be checked „manually", after which no validity of this data can be determined. Three of the images do not show said CO2 motif, in three images the average height was measured incorrectly by the CV algorithm, in an inaccurate one. Only two images of the output show both the subject and a suitable average height of the horizon line of 52.79% and 22.39%. Confirmation of the qualitative hypothesis therefore seems problematic.

CO2 emission 9 images 36,4% average height

< 69% bis ≤ 100%
2 line (22,2%)
average height: 69,6%

upper third ≥ 63% bis ≤ 69%
1 line (11,1%),
average height: 68,4%

central section >36 bis < 63%
1 line (11,1%)
average height: 52,8%

lower third ≥ 30% bis ≤ 36%
0 lines (0%)
average height: 0%

≥ 0% < 30%
5 lines (55,6%)
average height: 13,4%

3.3 Challenges of qualitative and quantitative image analysis methods

1 – If the art and image-scientific analysis of climate images at a pre-iconographic level is always exposed to reception in the sense of Panofsky's „practical experience" in accordance with collective memory structures, algorithmic image-intrinsic analysis is determined by computer vision, the automated recognition of the horizon line and height, by subjective-qualitative programming and a kind of „pragmatism of efficiency".

2 – If the „danger" of over-interpretation or „linguistic heteronomy" [5] arises in iconographic-iconological image analysis, quantitative analysis is dominated by an urge for optimisation and an underlying structural logic.

3 – With regard to the contextual embedding of digital climate images, the strongly selected or limited image corpus of the social media platform „Pinterest" of image scientific analysis is contrasted by a formally unlimited mass of data of quantitative image analysis. This results, among other things, in a difference in the creation and analysis of the image body. While this is selected for qualitative analysis according to predefined researched criteria and contexts, the scraping of the quantitative method is initially only roughly limited and the sample is filtered parallel to the evaluation of the data. This makes it possible to determine a different value of the image body in both methods. The qualitative investigation gives a strong data loyalty and a deep examination of the origin and intention of the image object, while the quantitative method is exposed to a strong data wear and is more interested in the connections between the data (pattern recognition) than in the individual date.

4 – If the qualitatively researched literature corpus is the basis for iconographic-iconological analysis, quantitative analysis is dependent on externally prepared data sources, programming interfaces (APIs) or algorithms. These are often characterised by services of technology and software companies whose „modes of operation" of their algorithms are difficult to understand (black box). Both the qualitative and the quantitative approach should therefore take data criticism and transparency into account.

5 – If, on a qualitative level, the challenge of disciplinary delimitation between art-historical, image-scientific, media-scientific and information-theoretical image observation arises, the problem of disciplinary exclusion, the transfer of data structure logic to a qualitative-hermeneutic approach, prevails in quantitative analysis.

5 – Boehm, Gottfried: „Iconic Turn. Ein Brief, W.J.T. Mitchell: Pictorial Turn. Eine Antwort – Ein Briefwechsel von 2006", In: Belting, Hans (Hrsg.) (2007): Bilderfragen: die Bildwissenschaften im Aufbruch, München: Wilhelm Fink, P. 34.

3.5 Fruitful interplay of qualitative and quantitative methods

1 – Not only on the level of metadata, but especially with regard to the image content itself, (if the error rate is minimised) an algorithmic image analysis by Computer Vision can certainly prove itself as a digital method for art studies in order to „compositionally" analyse a large mass of images that goes beyond qualitative „in-depth research" within a short time. This is the common argument of mass (Big Image Data), which suggests a higher promise of analysis with increasing examination data.

2 – A striking interface between the two approaches only emerged as a result of the interdisciplinary cooperation, in that it became apparent to what an extent the art and image-scientific method proceeds quantitatively in parts due to the focus of the image comparison itself and by no means can be described as the „genuine" discipline. These include, among other things, filtering the numerous digital photographs with regard to a formal image object (horizon) in the form of „pin boards" or measuring the height of the horizon using digital image processing. The quantitative method was also exposed to qualitative decision-making processes in various analytical steps: First in the conception of the algorithm, i.e. the conscious isolation of the image phenomenon from a complex context (experimental arrangement) and the breaking down of the horizon as an object of investigation into formalisable elements (divide and conquer). The programmer also made purely subjective distinctions in consultation with the qualitative question within the adjustment of the data basis or the individual functions, for example by changing the threshold values. Last but not least, the evaluation of the generated results and the subsequent change of the program in the sense of „translation" of the analysis of art and image studies form a qualitatively subjective act. Especially with regard to Creswell's separation of quantitative and qualitative methods, the specific „quantitative" of the supposedly quantitative method must now be asked. The critical approach to quantitative methods therefore consists in consciously perceiving and naming their qualitative dimensions in order not to produce a „false" idea of reliability and measurement accuracy (objectivity), which was identified as proble-

matic in the course of the horizontal analysis. On the basis of the direct comparison of methods, it became evident how difficult it is to speak of a purely qualitative or quantitative methodology.[6]

3 – An interesting gain in knowledge through data-based image analysis could now exist in ontological image observation. With regard to a reflection on image theory, an interesting translation process of image understanding became clear in the mixed use of methods: Due to the qualitative and quantitative analysis steps, the digitality of image quality enabled a constant and iterative change between the image as 1). phenomenon, as 2) data set, as 3) visualised table or finally as 4) statistical graphic. This means that we are dealing with a new approach to digital image objects, which provokes an ephemeral understanding of external (perceptible) image, image medium and data. Image analysis by means of algorithms (pattern recognition) is particularly interested in the data type of the image (pixels). In the application of these algorithms, non-image data types are assigned to the information from the images. Thus, in contrast to image-scientific analysis, quantitative image analysis never works with the images themselves, but with abstract non-images (Schirra). These digital data types must first be represented in order to generate meaning from them. In this process, visualisations emerge that bring with them their own conditions and modes of action of a subjective nature. Consequently, quantitative horizon analysis is a process in which horizon images can be transformed as non-images, processed and ultimately analysed using new (diagram) images.

4 – The first mixed-method image study also made the following observation possible: both the (phenomenal) iconographic-iconological analysis based on Panofsky's three-phase model of visual levels of meaning and the algorithmic analysis of the various data set formats lead to the understanding that imagery is an interplay of various image levels.[7] The pre-iconographic, iconographic and iconological image levels hierarchically structured by Erwin Panofsky are expanded in quantitative analysis by information-theoretical layers such as „information", „media system" and generation of the „visual phenomenon".[8]

6 – In the course of the anci project or future image studies, further critical examination of this statement is required.

7 – Cf. Klinke, Harald: „Bildwissenschaft ohne Bildbegriff". In: Ders.; Stamm, Lars (Hrsg.) (2013): Bilder der Gegenwart: Aspekte und Perspektiven des digitalen Wandels.

8 – Ibid., P. 24.

5 – A cognitive potential in the quantitative method now lies in using computer vision or pattern recognition to approach a new possibility, to analyse images iconically and to supplement Panosfky's cognitive model - regardless of a hierarchical evaluation of the image planes, whereby finally the computer-controlled pattern recognition can be understood as no less important cognitive level compared to the iconological one. This idea originated in the qualitative examination of Polar Sea photographs in which the CV algorithm misinterpreted the horizon lines: Although all image data sets were measured with the same tailored algorithm, the horizon line was not located at the transition of water and sky but on the structure of the ice floes below the actual horizon line for various images with wide water surfaces and white ice floes. Instead of the colour contrast of sky and sea as an evident, formal-aesthetic structural element, attention shifts to the ice floes or waves of the sea using the CV algorithm. Interestingly, this mark emphasises the iconographic statement of climate change, according to which the melting, breaking ice floes on the vast ocean surface symbolise global warming.

6 – In this way, it is possible to approach an iconic idea of pictoriality, which would be located even before Panofsky's pre-iconographic level of „practical experience", through error analysis.

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