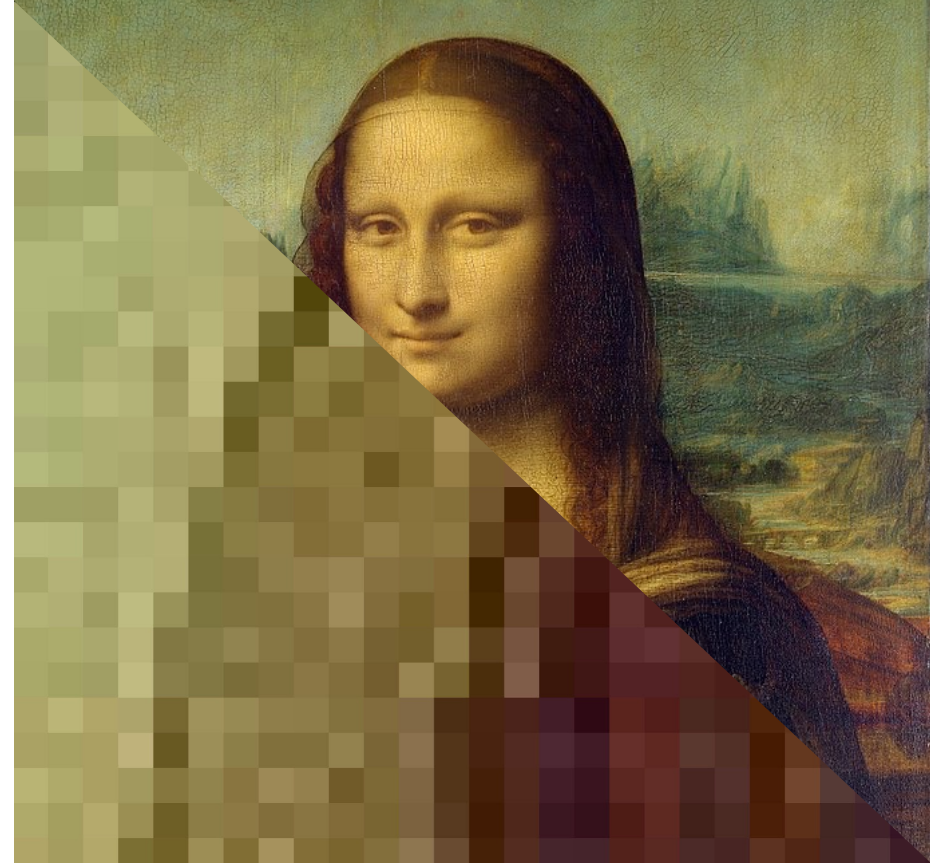


II. DIGITISATION AND DATA MANAGEMENT

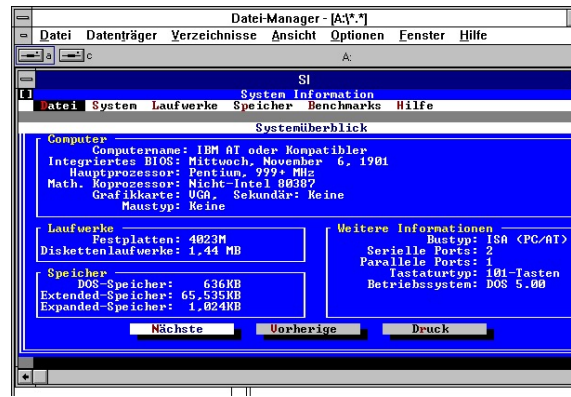
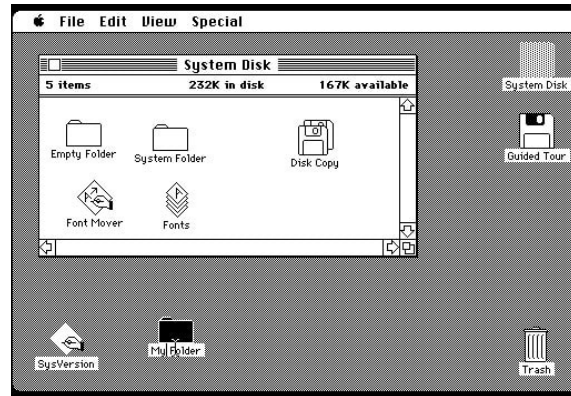
3. The Digital Image

Prof. Dr. Martin Langner

Schreibman / Siemens / Unsworth (2016) Kap. 17;
Jannidis / Kohle / Rehbein (2017) Kap. 12
Schröter, Jens: Digitales Bild, in: Jörg R.J. Schirra u.a.
(Hg.): Glossar der Bildphilosophie, http://www.gib.uni-tuebingen.de/netzwerk/glossar/index.php?title=Digitales_Bild).



GRAPHIC USER INTERFACE, OPERATING SYSTEMS



Macintosh System 1 (1984)
Windows 3.1 (1985)

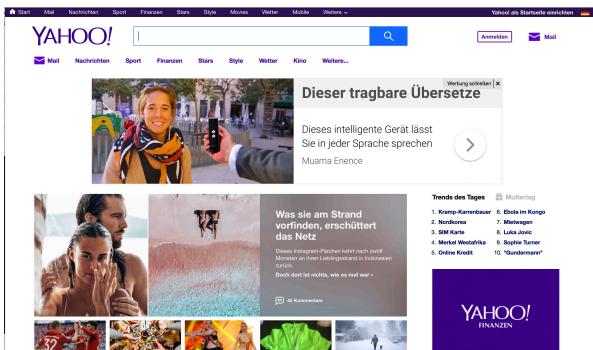


MacOS 10.12 (2016)
Windows 10 (2015)

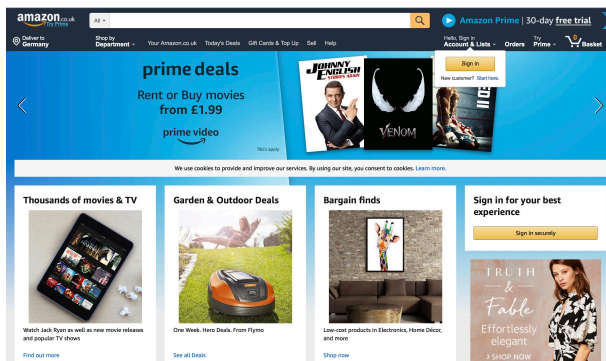


- Art - Illustration, Photography, Architecture ...
- Business and Economics (Beta) - Directory, Assessment, Classified ...
- Computers and Internet (Beta) - Internet, WWW, Software, Multimedia ...
- Education - University, K-12, Careers ...
- Entertainment (Beta) - TV, Movies, Music, Magazines ...
- Government - Politics (Beta), Airlines, Air, Military ...
- Health (Beta) - Medicine, Drugs, Diseases, Fitness ...
- News (Beta) - World (Beta), Daily Current Events ...
- Recreation and Sports (Beta) - Sports, Games, Travel, Auto, Outdoors ...
- Reference - Citations, Dictionaries, Chat, Numbers ...
- Regional - Countries, Regions, U.S. States ...
- Science - CS, Biology, Astronomy, Engineering ...
- Social Science - Anthropology, Sociology, Economics ...
- Society and Culture - People, Environment, Religion ...

Yahoo! News, Yahoo! Shop, Yahoo! Finance
 Yahoo! Japan, Yahoo! Internet Life, Yahoo! Site Finder



Yahoo 1995
Yahoo 2019



Amazon 1995
Amazon 2019



The Telegraph 1995
The Telegraph 2019

Iconic Turn: Social communication becomes visual

- Letterpress printing
- Copperplate engraving
- Photography and film
- Digital Photography

Ariane Mensger (ed.), *Déjà-vu? Die Kunst der Wiederholung von Dürer bis YouTube*, Ausst. Karlsruhe (Bielefeld, 2012)

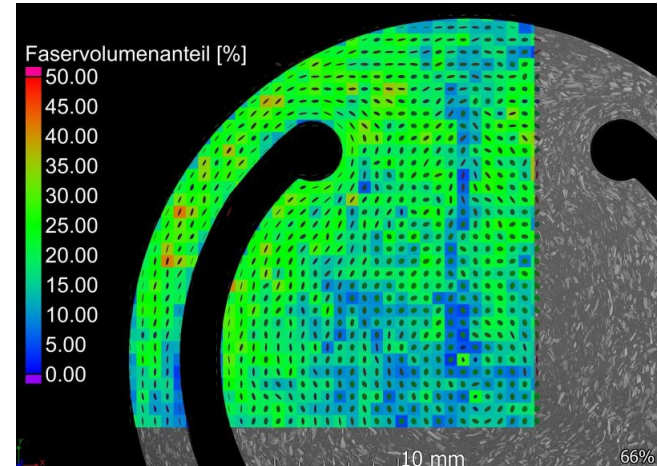
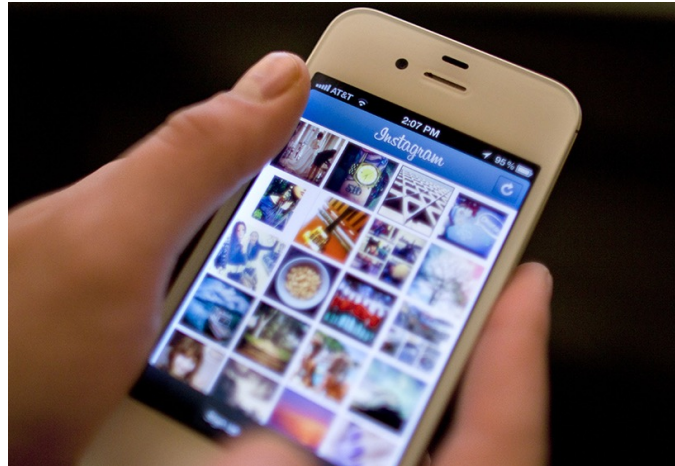


Albrecht Dürer, Ritter, Tod und Teufel (1513);
Hermann Krone, Selbstporträt mit Teilen seiner Ausrüstung (1858)



„In general, images cannot be true or false because they have no unequivocal predicate to which truth or falsehood can be related. Images produce evidence.“

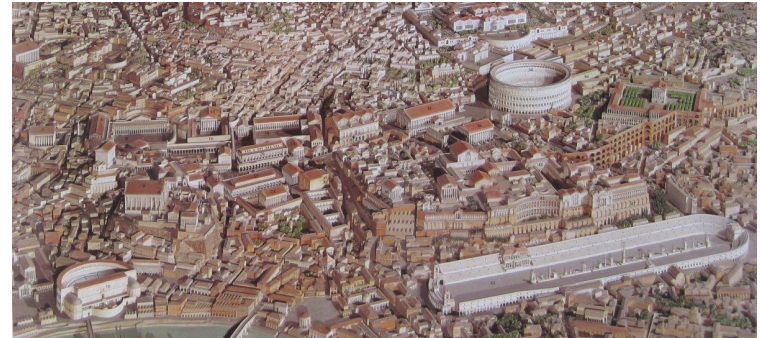
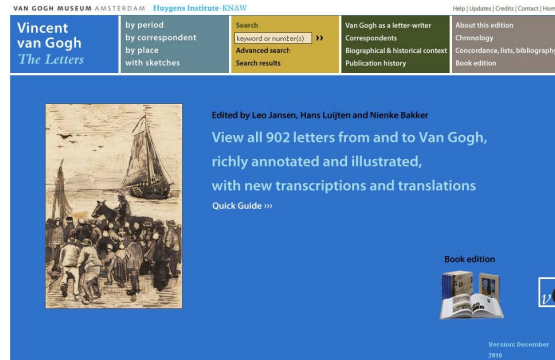
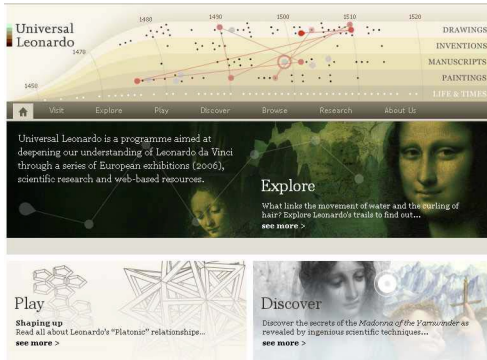
Increase of visually presented statements in social and scientific discussions and their fluidity



Renate Brosch, *Bilderflut und Bildverstehen. Neue Wege der Kulturwissenschaft*, Universität Stuttgart, Themenheft Forschung 4 (2007), 70–78 (<https://www.uni-stuttgart.de/presse/archiv/themenheft/04/bilderflut.pdf>)

Canonisation

- Digitisation has mostly led to a further narrowing of the art canon in art historical and archaeological projects.

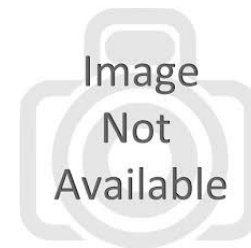


Rome Reborn (2007-2012) und das Rommodell im Museo della Civiltà Romana (1933-1971)

Margarete Pratschke, „Digitalität und Kunstgeschichte“, in: *Digitalität. Theorien und Praktiken des Digitalen in den Geisteswissenschaften*, Symposium in der Villa Vigoni, 26.-29.05.2016 (<https://digeist.hypotheses.org/99#more-99>)

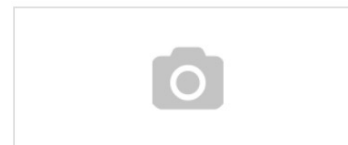
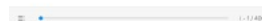
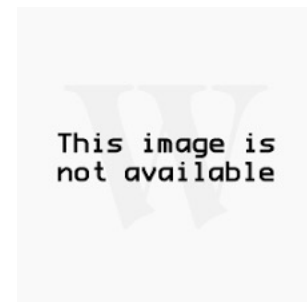
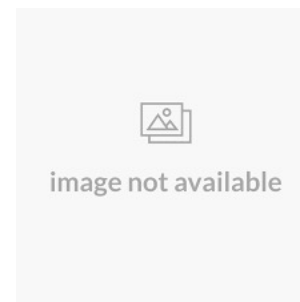
Image restrictions

Image Not Available Online - [Details](#)



*image
not
available*

**No image
available**



Margarete Pratschke, „Digitalität und Kunstgeschichte“, in: *Digitalität. Theorien und Praktiken des Digitalen in den Geisteswissenschaften*, Symposium in der Villa Vigoni, 26.-29.05.2016 (<https://digigeist.hypotheses.org/99#more-99>)

1. FROM CODE TO IMAGE

- a) Pixel and vector graphics
- b) Image size, resolution
- c) Colour depth and colour space
- d) Processing and storage

2. THE DIGITAL IMAGE

- a) Image data: Definition
- b) Properties of the Digital Image
- c) The Digital Image as a Double Image

3. DIGITAL ACQUISITION

- a) Text oriented
- b) Image oriented
- c) Annotation vs. Pattern Recognition



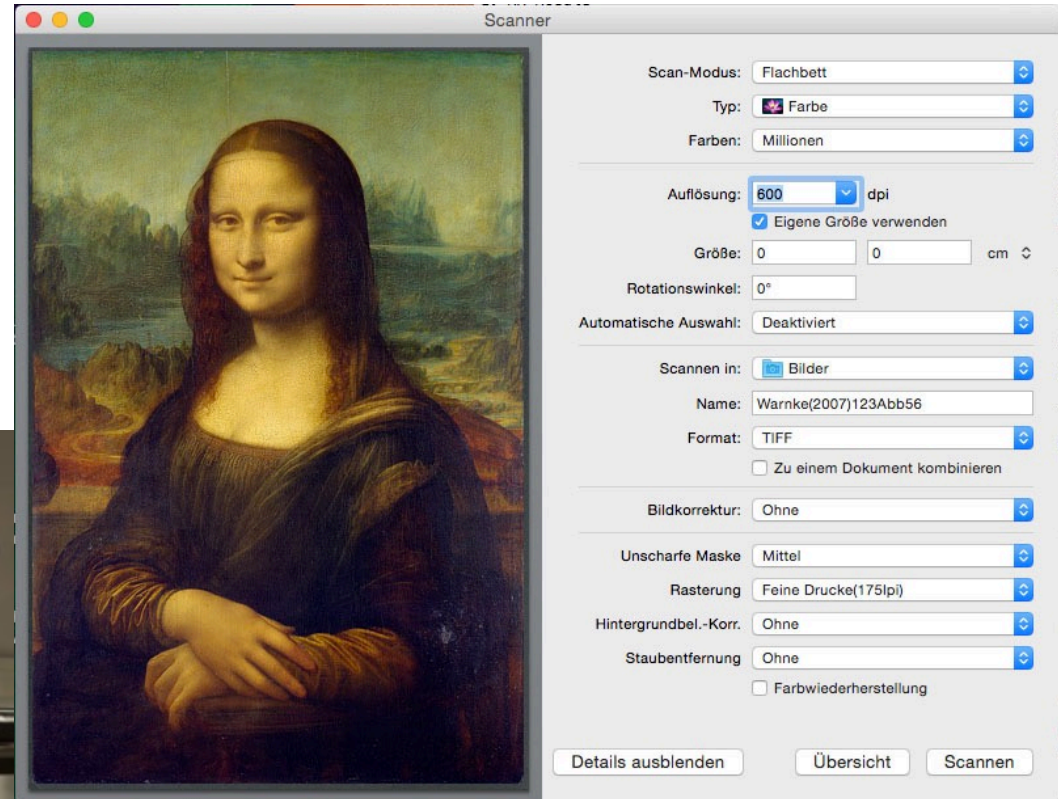
1. FROM CODE TO IMAGE





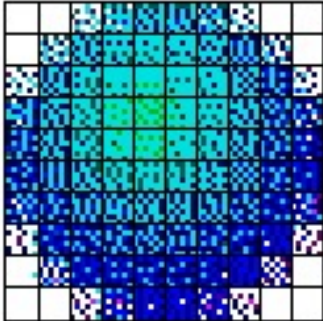
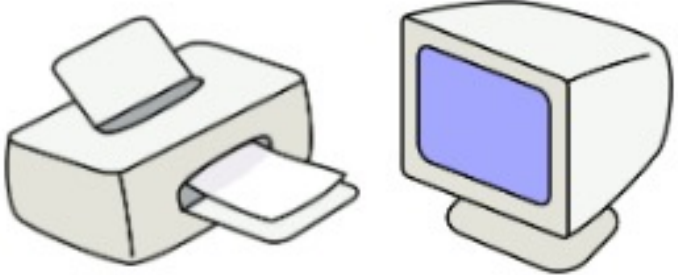
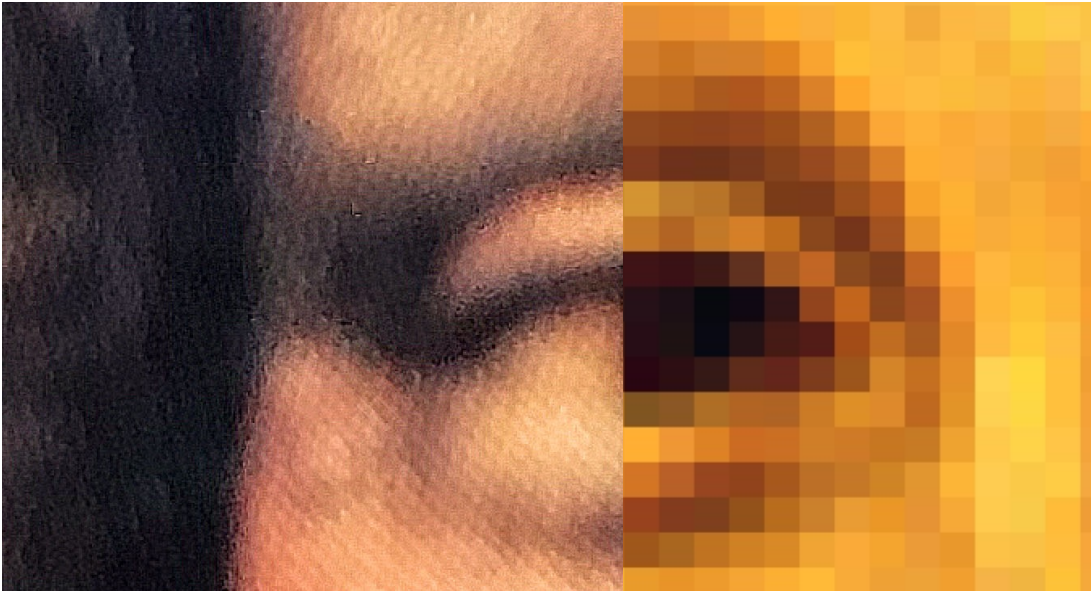
Scanner for photos and pictures from books

- Image capture device with light-sensitive sensors

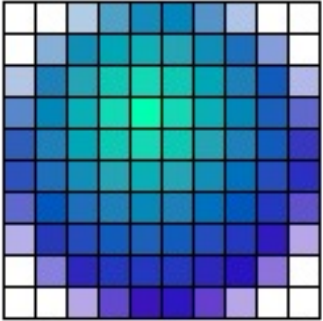


Raster graphic or Bitmap image

- consists of individual image points (picture elements = pixels).



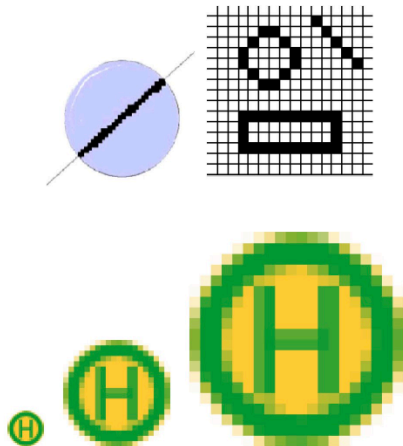
dpi (Dots per inch)



ppi (Pixel per inch)

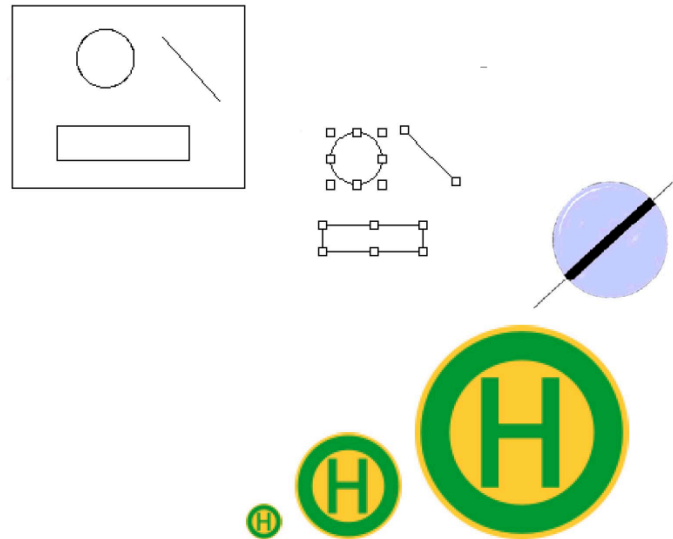
Bitmap images

- consists of individual image points (picture elements = pixels).
- Each point is stored in its position, colour value and brightness.



Vector graphics

- consists of individual lines
- can be scaled as desired without loss of quality

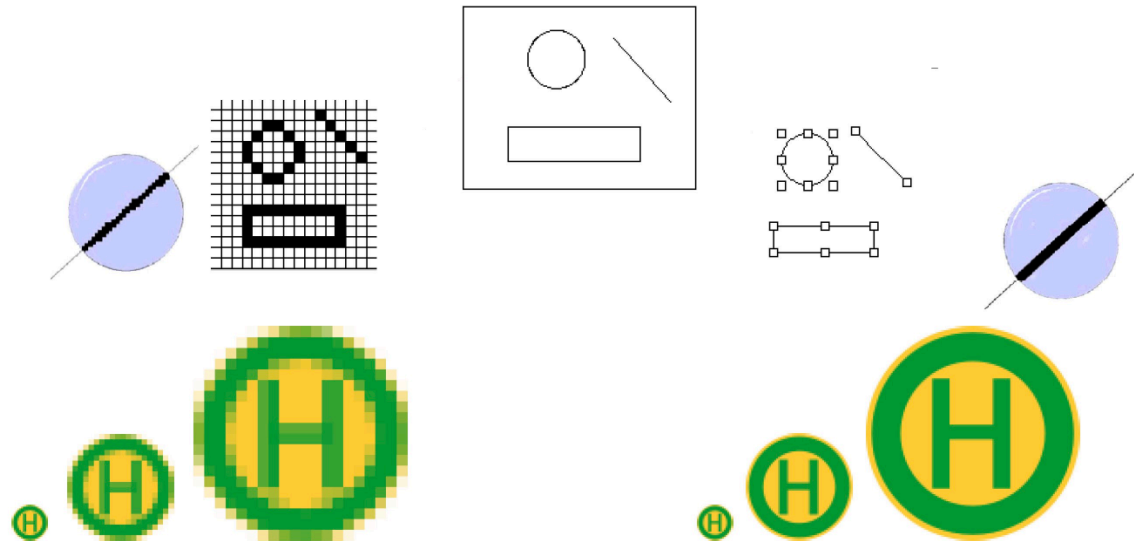


Bitmap images

Vector graphics

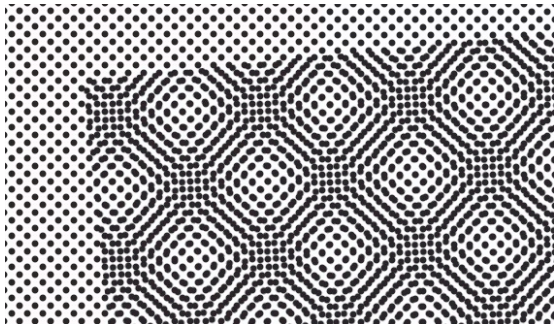
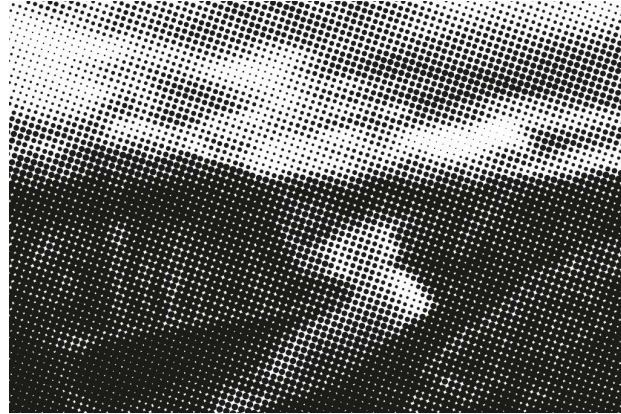
Vectorisation

Rendering



Rasterisation

Images are rasterised differently for display in print than on the screen. Therefore, Moiré effects tend to occur when scanning.



Moiré Effect



Amplitude-modulated rasterisation



Frequency-modulated rasterisation

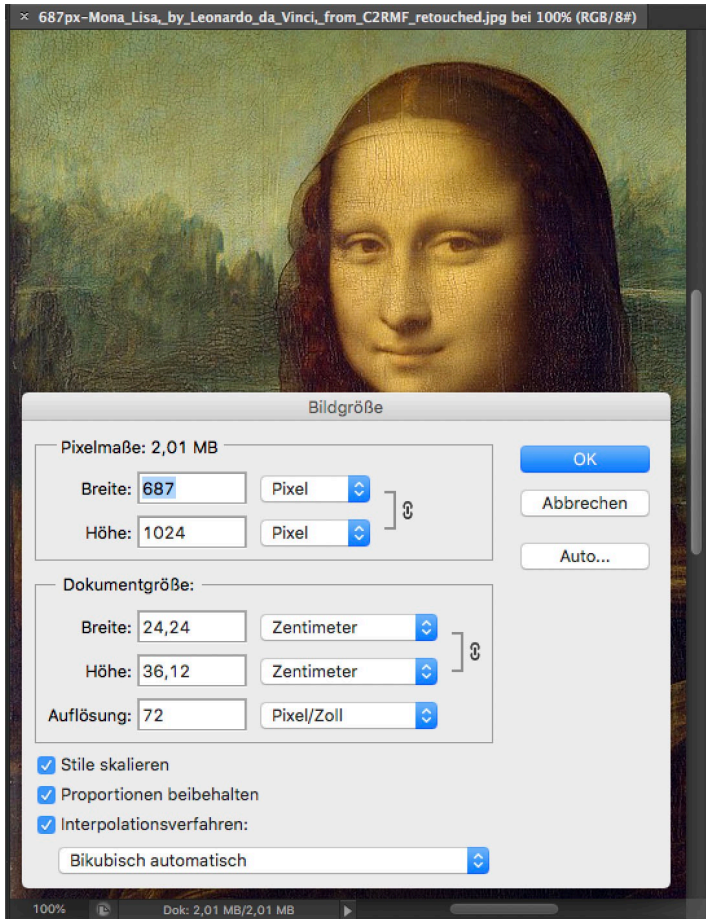


Image Size, Resolution

Raster screens are used as output devices for the digital image, which display the image as a raster of image points (pixels), each of which is assigned a color value.

Image size is the width × height in pixels, e.g. 600 × 900 px.

Monitors usually have a **resolution** of 72 pixels / inch (inch), but newer ones are significantly higher. 300 dpi (dots per inch) are mostly used for printing.

Dithering

- Optical help (simulation) for colour optimisation and scaling
Colours that do not exist are simulated by displaying a mixture of neighboring colours.
- “**Diffusion**” is the chosen dithering method. It scatters the pixels in a random pattern.



Colour depth

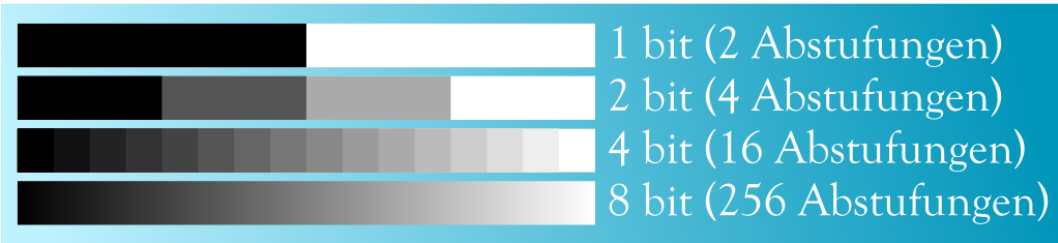
A pixel in a black-and-white graphic requires exactly one bit. If the bit is 1, the pixel becomes black, if it is 0, it remains white.

$100 \times 100 \text{ Pixel} = 100 \times 100 \times 1 \text{ Bit} = 10.000 \text{ Bit} = 1250 \text{ Byte} = 1,22 \text{ kByte}$.

Colour depth 8 Bit = 256 colours: $100 \times 100 \times 8 \text{ Bit} = 80.000 \text{ Bit} = 10.000 \text{ Byte} = 9,76 \text{ kByte}$.

Colour depth 24 Bit = 16.777.216 colours: $100 \times 100 \times 24 \text{ Bit} = 240.000 \text{ Bit} = 30.000 \text{ Byte} = 29,3 \text{ kByte}$.

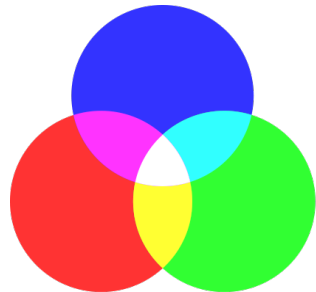
Colour depth in Bit	Number of colours per pixel	File size in byte
1	2	9.600
4	16	38.400
8	256	76.800
16	65.536	153.600
24	16.777.216	230.400
32	4.284.907.290	307.200



Farbraum

▪ Physiological colour mixing (RGB):

All colours of the colour wheel are created by mixing light, i.e. the wavelengths of the three primary colours red, green and blue are added (superimposed).



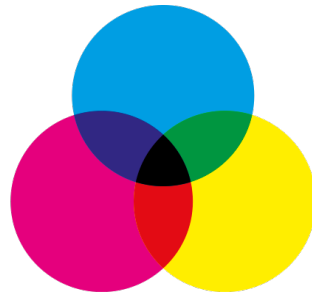
RGB

▪ Physical colour mixing (CMYK):

- Generative colour model that describes the technical mixing ratios of its four basic colours.

- describes the change of a colour stimulus when reflected on the surface of a body.

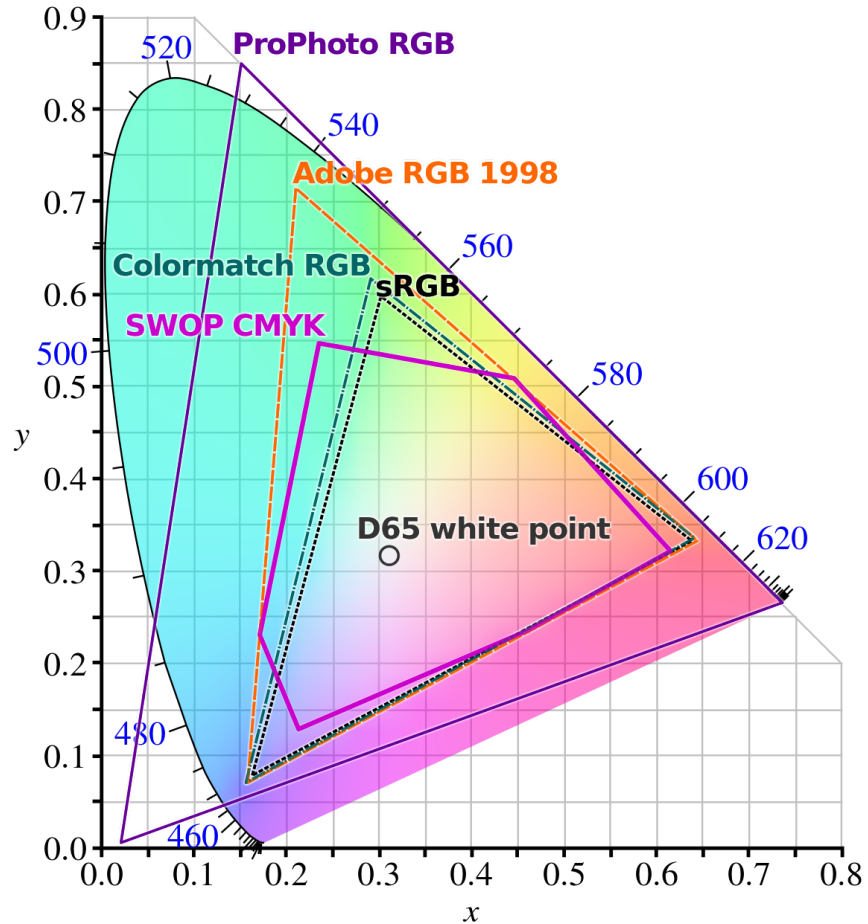
With the help of three colour filters **cyan**, **magenta** and **yellow** connected in series, colours are not mixed, but a change in the light spectrum takes place, as a result of which only changed colours are seen.



CMYK

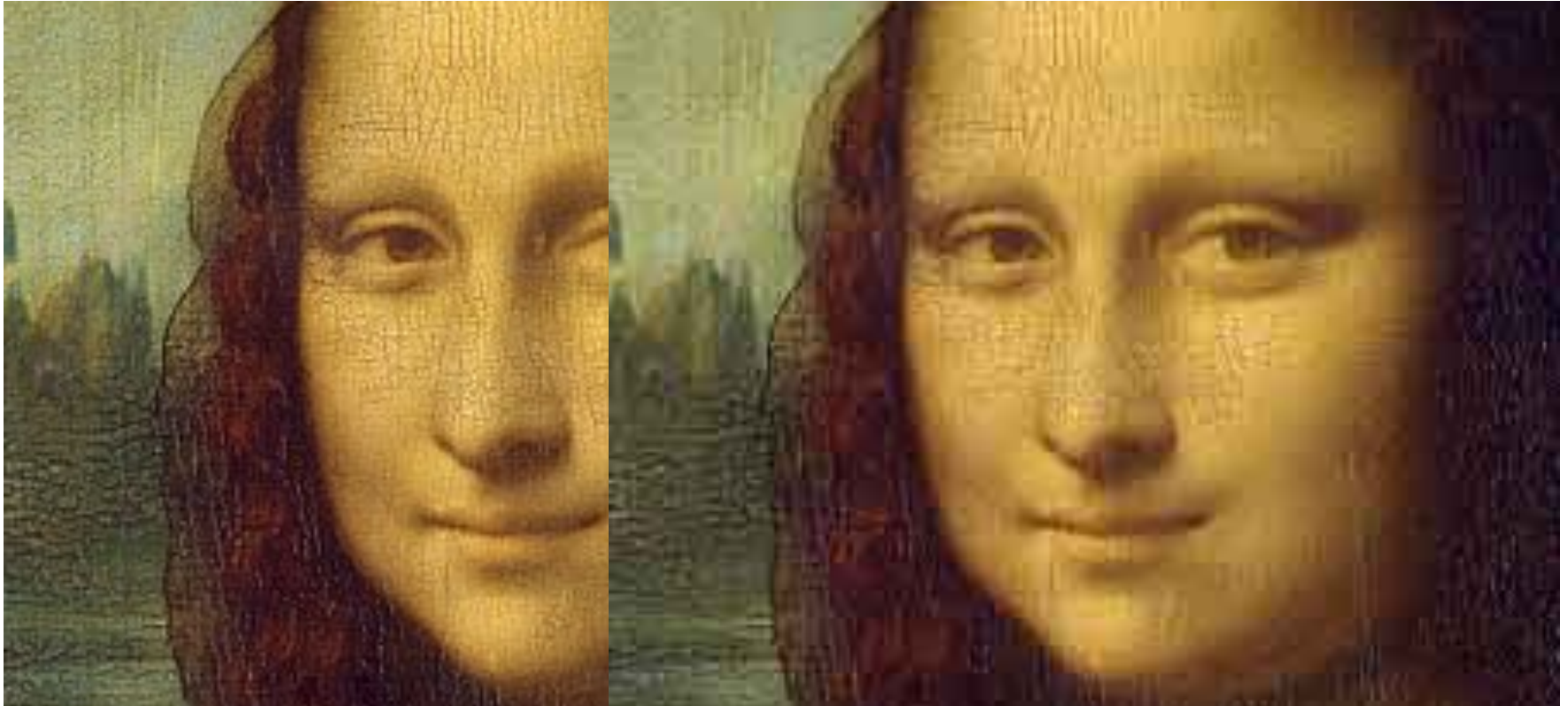
Colour space

- The colour space of the human eye is larger than that of the screen display (RGB).
- In print (CMYK), not even half of the colours can be represented. A scanned image therefore often looks different on screen than it does when printed..



https://en.wikipedia.org/wiki/Color_space

Komprimierung (Bsp.: JPEG Kompression)



Typical image defects

1. Image noise (luminance noise, colour noise)
2. Chromatic aberration (colour fringing)
3. Spherical aberration (blurring)
4. Distortions (distortion / barrel and pincushion)
5. Geometric distortions (plunging lines)
6. Vignetting, image field curvature
7. Smearing/smear effect
8. Banding/streaking
9. Blooming
10. Rolling shutter effect
11. Moiré
12. JPEG artefacts
13. Dust



Automatic batch processing for similar process steps

- Size
- Format
- Resolution
- Tags
- Metadata
- XMP etc.

Stapelverarbeitung

Abspielen

Satz: Standardaktionen

Aktion: 600dpi

Quelle: Ordner

Wählen... Macintosh HD:Users:Shared:Forschung:Attis

Dateien nur öffnen, wenn Aktionsset Befehl "Öffnen" enthält

Alle Unterordner einschließen

Keine Optionsdialogfelder für "Datei öffnen" anzeigen

Farbprofil-Warnungen unterdrücken

OK

Abbrechen

Name	Größe	Art	Tags
577295001.jpg	514 KB	JPEG-Bild	--
461515001.jpg	280 KB	JPEG-Bild	--
476698001.jpg	212 KB	JPEG-Bild	--
1613035745.jpg	202 KB	JPEG-Bild	--
477211001.jpg	227 KB	JPEG-Bild	--
477308001.jpg	216 KB	JPEG-Bild	--
1613112635.jpg	449 KB	JPEG-Bild	--
276836001.jpg	318 KB	JPEG-Bild	--
476744001.jpg	375 KB	JPEG-Bild	--
276875001.jpg	290 KB	JPEG-Bild	--
476701001.jpg	461 KB	JPEG-Bild	--
476775001.jpg	464 KB	JPEG-Bild	--
483090001.jpg	424 KB	JPEG-Bild	--
477213001.jpg	331 KB	JPEG-Bild	--
477300001.jpg	231 KB	JPEG-Bild	--
1434247001.jpg	461 KB	JPEG-Bild	--
453500001.jpg	397 KB	JPEG-Bild	--

Heute, 03:59

Heute, 03:59

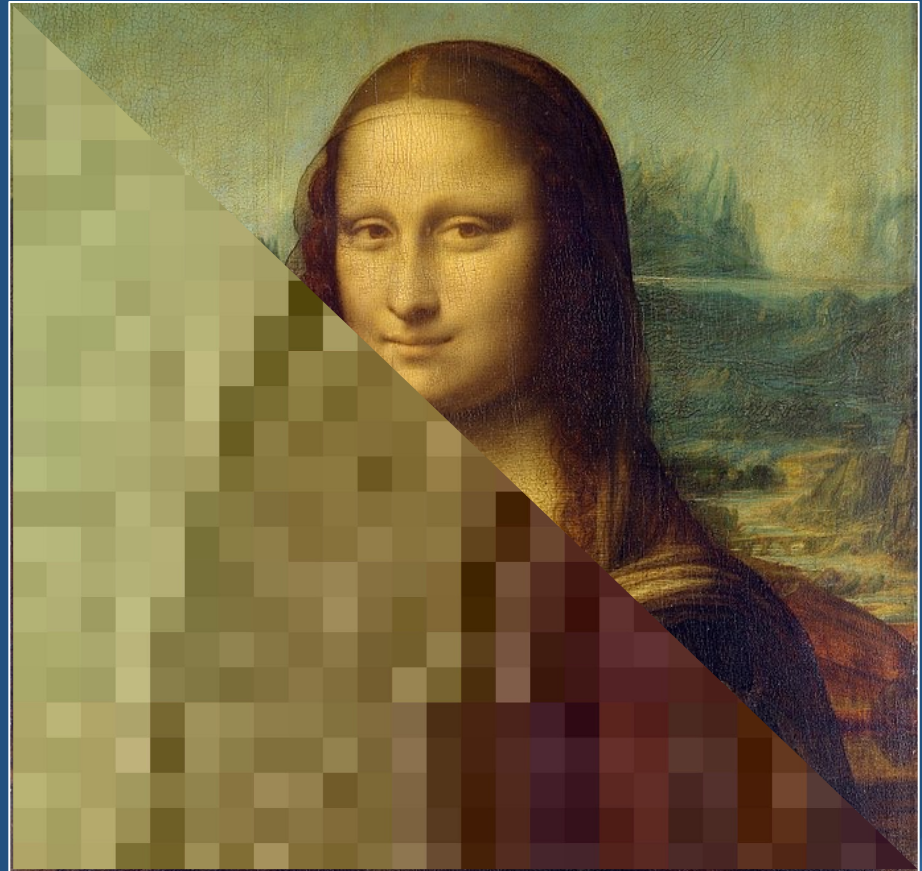


Dateiformate

Suffix	.svg (Scalable Vector Graphic Format)	.png (Portable Net- work Graphics Format)	.jpg / .jpeg (Joint Photo- graphic Experts Group)	.gif (Graphics Interchange Format)	.tif (Tagget Image File Format)
max. number of colours	24	281 Bio (48 bit)	256 (8-Bit)	256 (2-8 bit)	65.536 (16 bit)
Pixel/Vector	Vector	Pixel	Pixel	Pixel	Pixel
Cropping	yes	yes	no	yes	yes
Compression with loss?	no	yes	yes	yes	no
Animation	yes	no	no	yes	no



2. THE DIGITAL IMAGE





What exactly is an image?

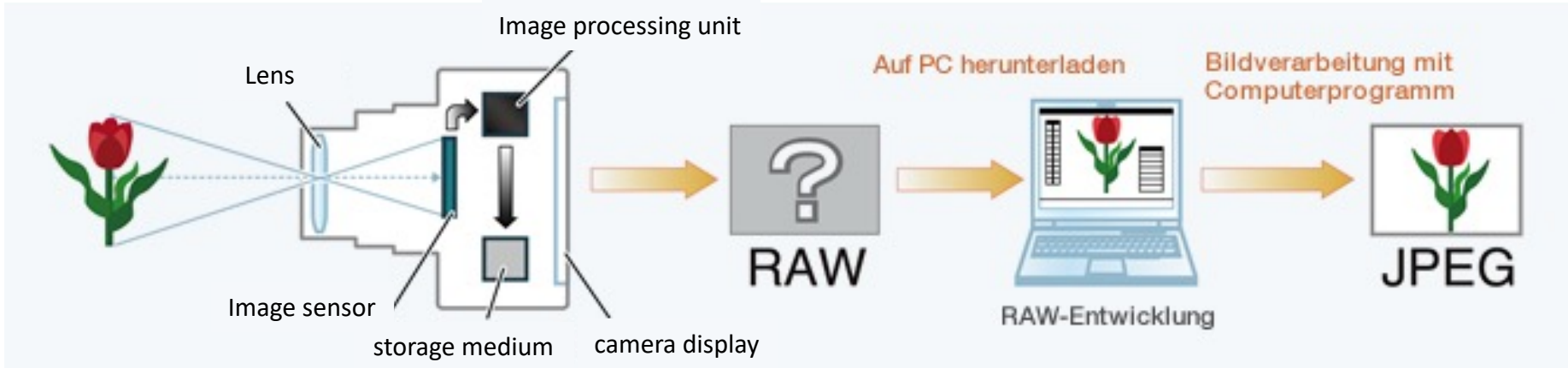
„What we encounter as an image is based on a single basic contrast, that between a manageable total area and all that it includes in terms of internal events. The relationship between the vivid whole and what it contains in terms of individual determinations (of colour, form, figure etc.) has been optimised in some way by the artist“

Gottfried Boehm (ed.), *Was ist ein Bild?* (München: Fink, 1994)





The Digital Image



Informations

- visualise → Display or printer
- change → Image editing software
- distribute → email, internet, computer game etc.



The digital image

- is not existing

Claus Pias, „Das digitale Bild gibt es nicht. Über das (Nicht-)

Wissen der Bilder und die informatische Illusion,“ in *Zeitenblicke* 2, no. 1 (2003),

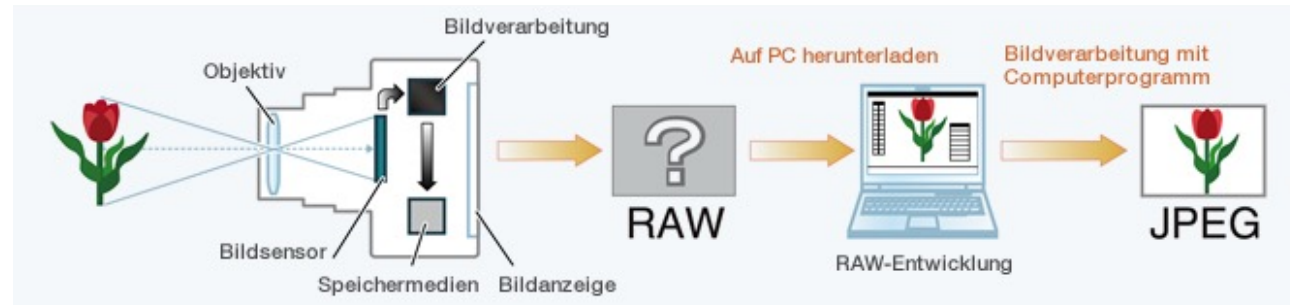
<http://www.zeitenblicke.historicum.net/2003/01/pias/index.html>

- is an image-like phenomenon with concrete properties created with digital code

Jens Schröter, „Digitales Bild,“ in *IMAGE* 25, Januar 2017, 89–106 (Erstabdruck 2013 in: Jörg R.J. Schirra u.a. (eds.): *Glossar der Bildphilosophie*, http://www.gib.uni-tuebingen.de/netzwerk/glossar/index.php?title=Digitales_Bild).

- Visual information

Harald Klinke, „Bildwissenschaft ohne Bildbegriff,“ in Harald Klinke und Lars Stamm (eds.), *Bilder der Gegenwart. Aspekte und Perspektiven des digitalen Wandels* (Göttingen, 2013) 11–28.





A universal concept of image

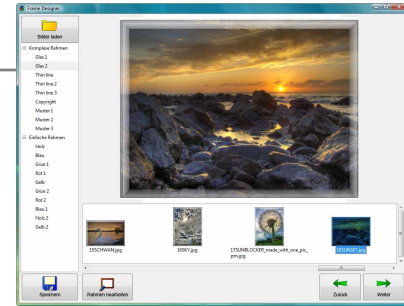
- 1. Information
- 2. Medium
- 3. Visual Phenomenon

Painting



- 1. colour information in bound pigments.
- 2. image carrier (wood, canvas, etc.)

Digital picture



- 1. colour information in bits
- 2. output on the display (variable brightness values of the RGB subpixel)

Photo



- 1. brightness information in silver nitrate molecules
- 2. image carrier (silver gelatine on paper)



Layer model of image science

1. Information

2. Medium, media system

3. Visual Phenomenon

4. Object detection

5. Pre-iconographic description

6. Iconographic analysis

7. Iconological interpretation

Harald Klinke, „Bildwissenschaft ohne Bildbegriff,“ in Harald Klinke und Lars Stamm (eds.), *Bilder der Gegenwart. Aspekte und Perspektiven des digitalen Wandels* (Göttingen, 2013) 11–28.



File formats (structure of an image file)

Raster graphics

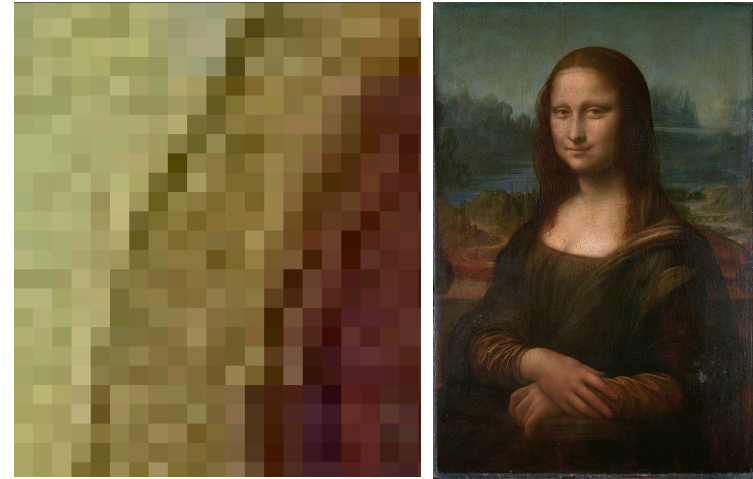
e.g. Windows Bitmap (BMP), Digital Negative (DNG), Graphics Interchange Format (GIF), JPEG File Interchange Format (JFIF), Portable network Graphics (PNG), Photoshop Document (PSD), RAW Graphics Format, Tagged Image File Format (TIFF)

Vector graphics

e.g. Adobe Illustrator (AI), Encapsulated PostScript (EPS), Windows Metafile (WMF), Windows Enhanced Metafile (EMF)

Annotated lists of file formats for images:

https://en.wikipedia.org/wiki/Image_file_formats

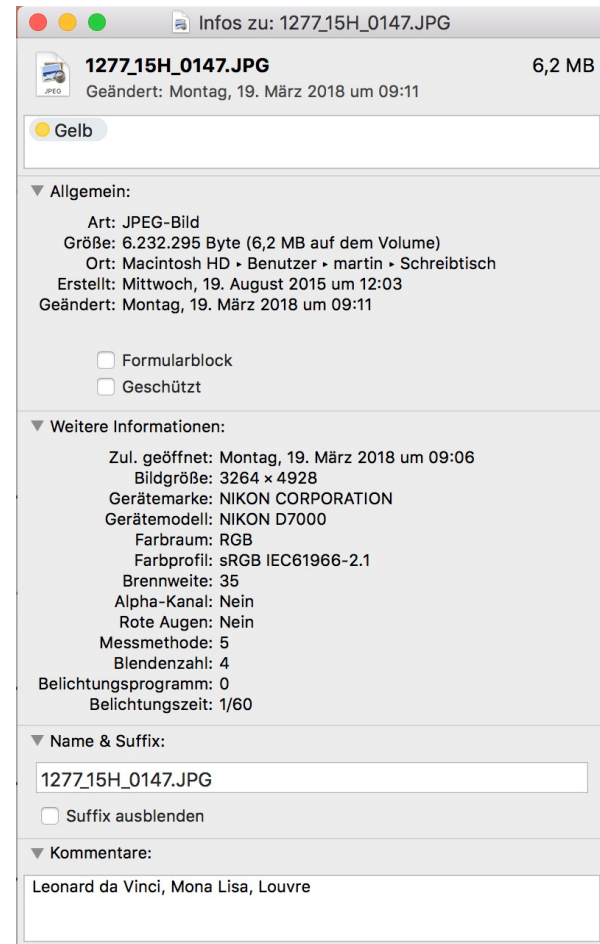




Structure of an image file

Metadata stored in the image file:

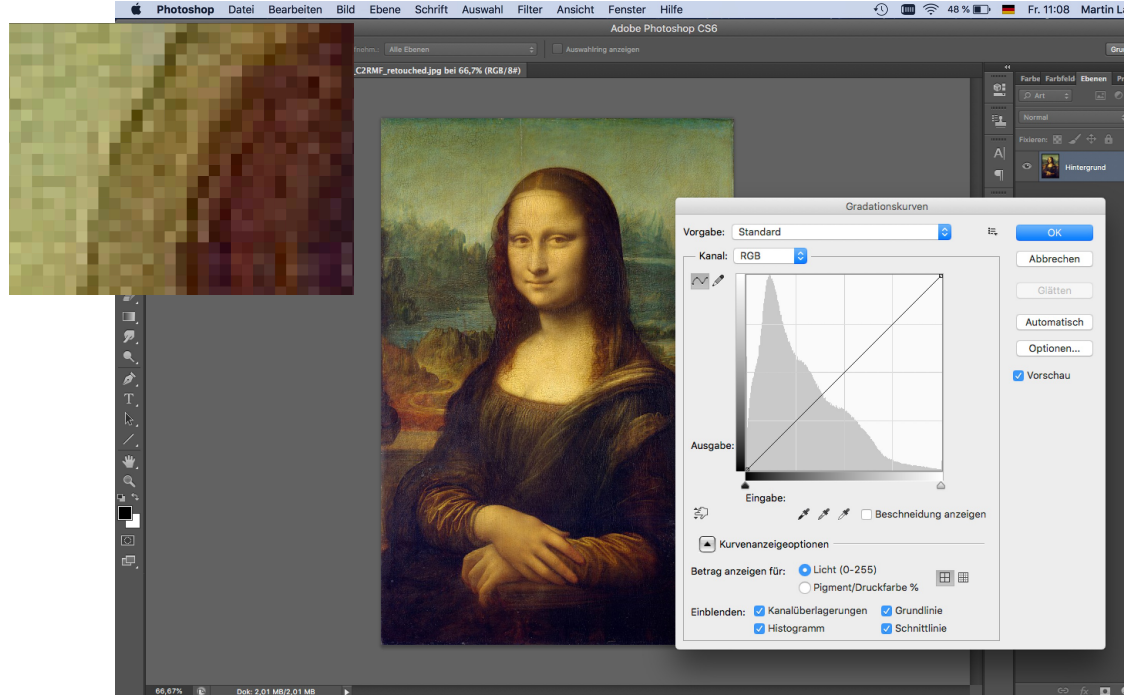
- Camera data (exposure time, aperture, etc.)
- Automatically generated information (date, shooting coordinates)
- Text fields for describing the image content





Granularity and addressability

Pixel and gradation curves
≠ textually described illustration

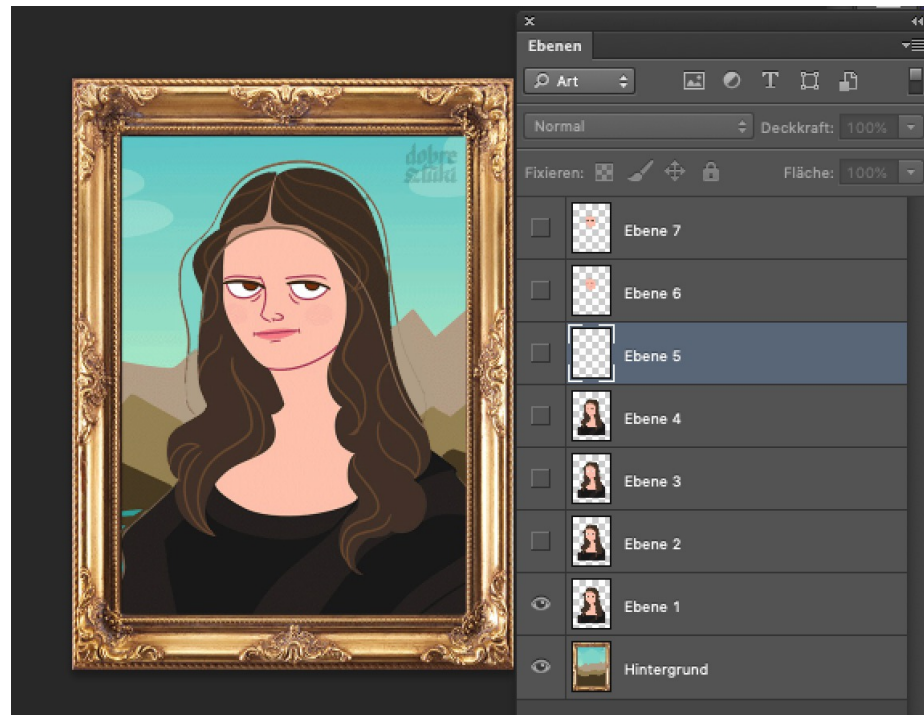


Martin Warnke, „Digitale Schreibzeuge,“ in Hubertus Kohle (ed.): *Kunstgeschichte digital. Eine Einführung für Praktiker und Studierende* (Berlin, 1997)



Granularity and addressability

- Transparency
- Layers





Manipulability

- Colour corrections and distortions are possible without leaving traces



www.buzzfeednews.com/article/davidmack/obama-fake-news-jordan-peeel-psa-video-buzzfeed



Manipulability

- Colour corrections and distortions are possible without leaving traces



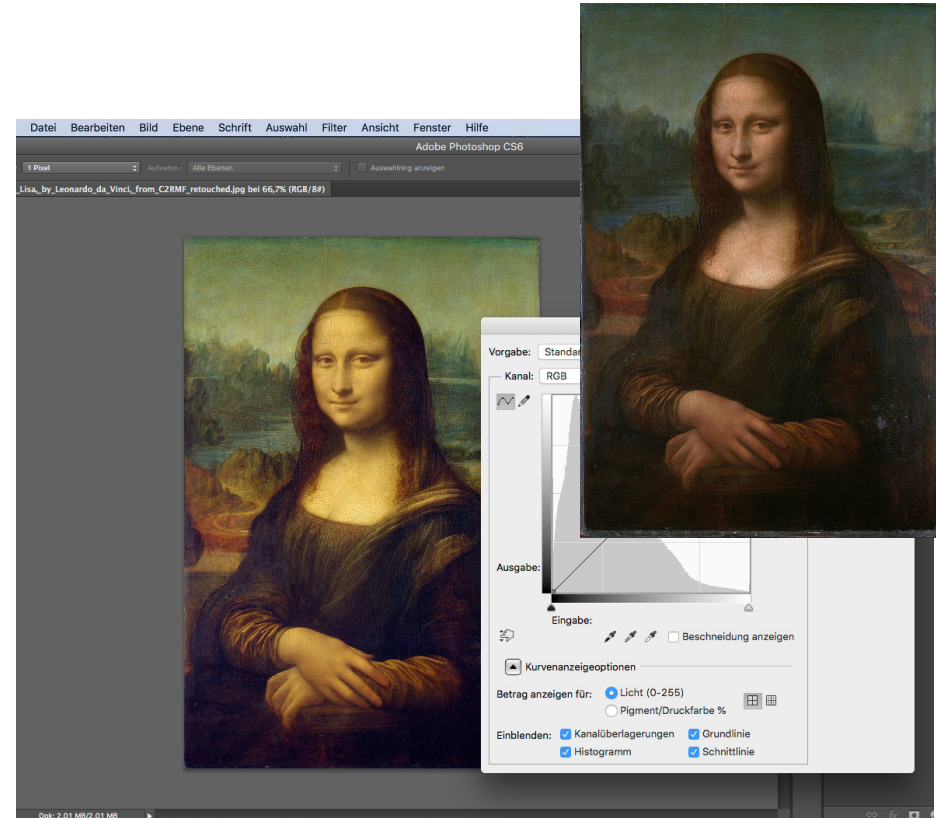
A rare photo of President Abraham Lincoln with his iPhone that he won by sharing a post on Facebook.

Please don't say this was "photoshopped." There was no Photoshop back then.



Variability and Processability

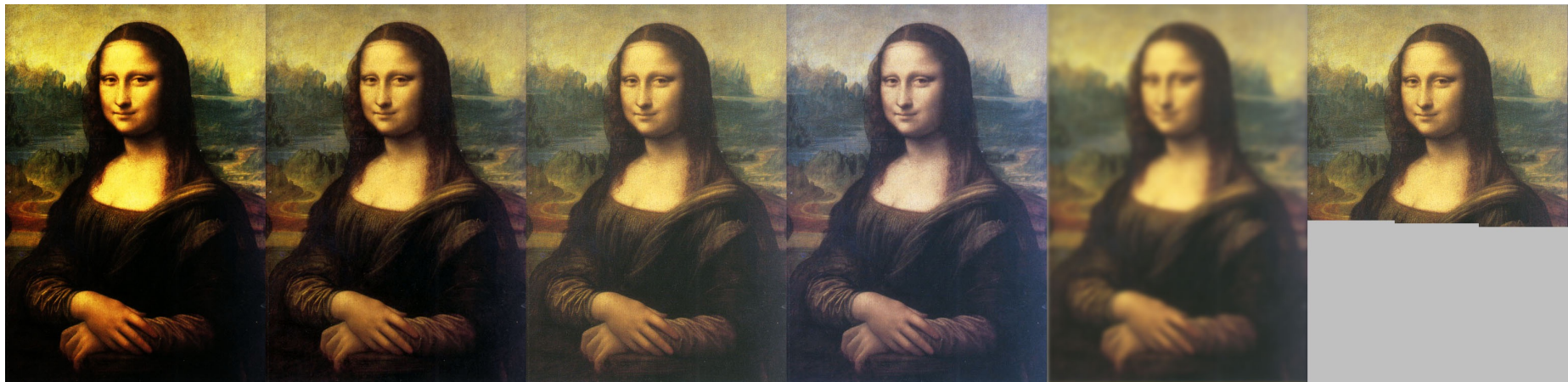
- Colour corrections and adulterations are possible without leaving traces
- Construction of reality, simulation instead of representation
- advantage:
 - restore past states
 - lossless copy





Fluidity, Performativity and Reconfiguration

are important concepts of the digital, because the digital image is always only a temporal manifestation and virtual configuration of information.



Marijke Goeting, „Digital Fluidity. The Performative and Reconfigurable Nature of the Digital Image in Contemporary Art and Design,“ *The International Journal of New Media, Technology and the Arts* 11 no. 4 (2016), 27–46



Ubiquity

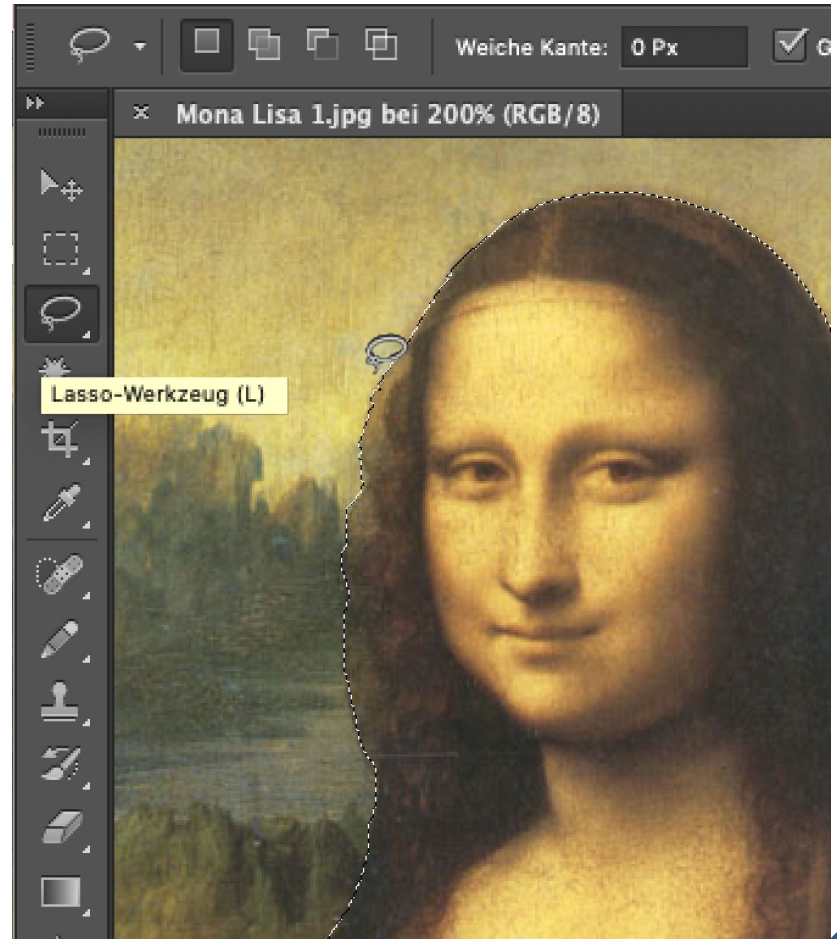
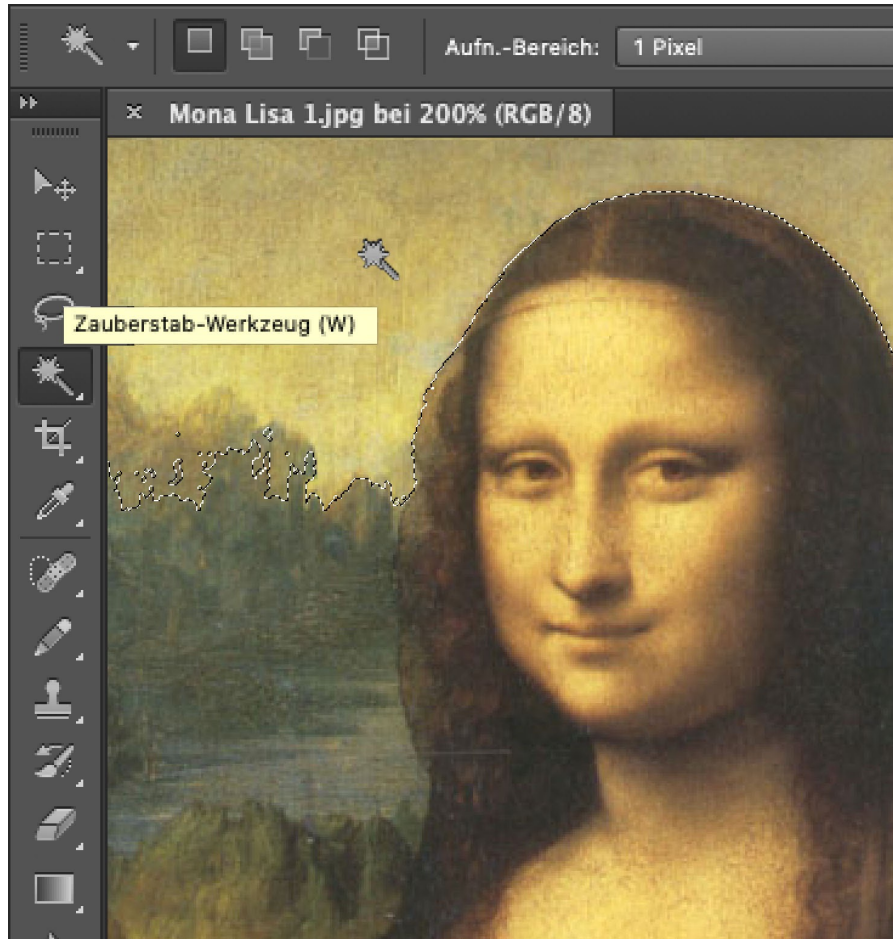
- available as code simultaneously and globally
- scientifically usable
- delocalised processing, crowdsourcing

André Gunthert, *L'image partagée. La photographie numérique* (Paris 2015)



Hubertus Kohle, *Das digitale Bild. Eine Herausforderung für die Kunstgeschichte:*

<https://blog.arthistoricum.net/beitrag/2018/02/09/das-digitale-bild-eine-herausforderung-fuer-die-kunstgeschichte/>





It is not inherent in the code to be interpreted as an image and to be represented as such on the surface. Rather, it is the result of an imaging process, which is why the same appearance can be encoded differently or the same code can be represented differently.



Mona Lisa 1.jpg



Mona Lisa 1.pdf



Mona Lisa 1.png



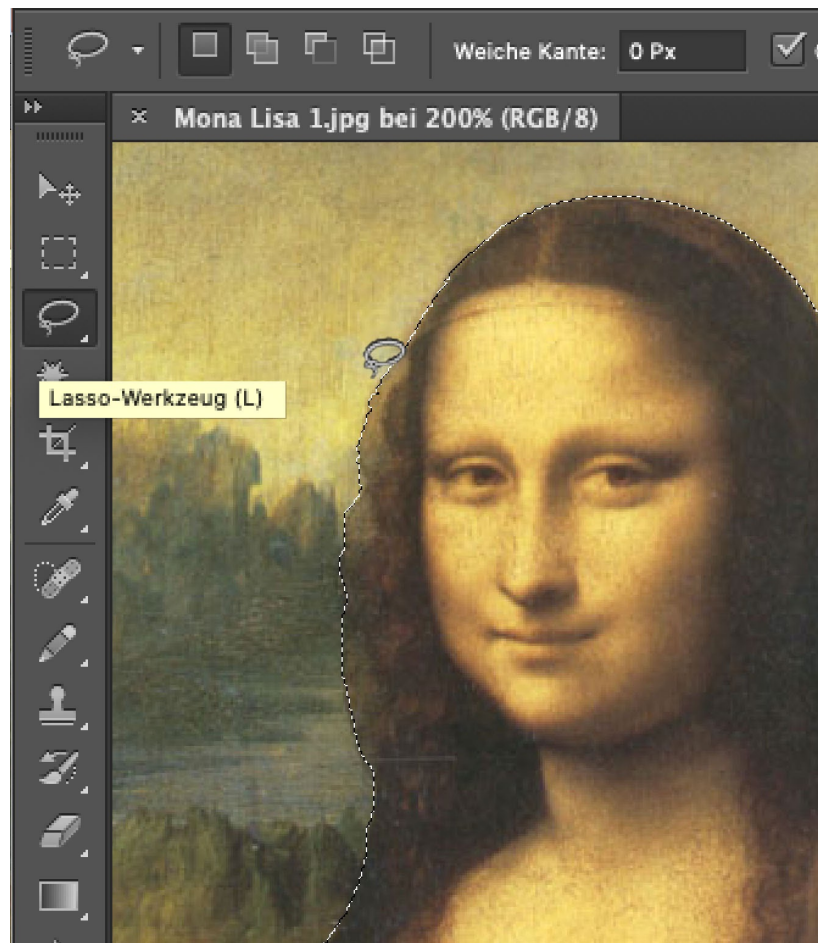
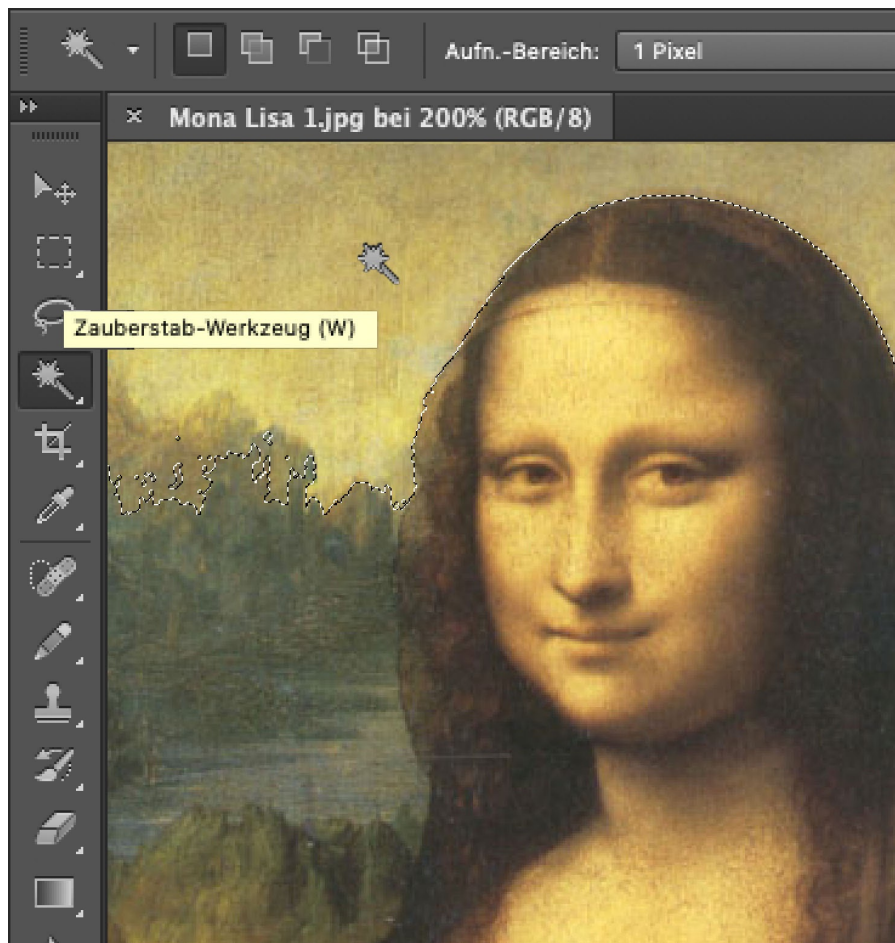
Mona Lisa 1.tiff



Dies ist nur ein
Beispieltext.

Dies ist
nur ein
Beispiel
text.







```
SELECT LEONARDO.ID,  
LEONARDO.Werk  
FROM ID;
```

ID	Werk
129	Mona Lisa
206	Annunziatazione
208	San Girolamo
278	Ultima Cena
282	Madonna Litta
331	Salvator Mundi
352	Scapigliata
391	Bacco
452	Madonna Benois
463	Sant'Anna, la
530	Annunziatazione
639	San Giovanni B
*	0








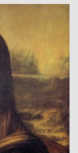
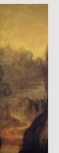

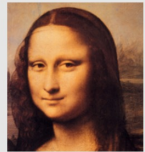











3. DIGITAL ACQUISITION

Pool: Wechsel im Connector-Modus nicht möglich

Suchen **Erweiterte Suche** In Ergebnis

0 / 0 / 49 Standard Er

Morimura, Yasumasa Mona Lisa in its Pregnanc...	Morimura, Yasumasa Mona Lisa in its Origin	Salai, Safet; Leonardo da' Mona Lisa	Leonardo da Vinci (nach) Mona Lisa	Leonardo da Vinci (nach) Mona Lisa
				
Leonardo da Vinci (nach) Mona Lisa, Modifikation	Leonardo da Vinci (nach) T-Shirt, Leonardo da Vinc...	Leonardo da Vinci Mona Lisa, Detail	Leonardo da Vinci Mona Lisa, Detail	Leonardo da Vinci Mona Lisa, Hände, Detail
				
Leonardo da Vinci Mona Lisa, Detail	Leonardo da Vinci Mona Lisa, Detail	Leonardo da Vinci Mona Lisa, Detail	Polke, Sigmar Mona Lisa	Duchamp, Marcel L.H.O.O.Q. (Kopie von 19...
				
Duchamp, Marcel From or by Marcel Duchamp...	Rauschenberg, Robert Ohne Titel (Mona Lisa)	Leonardo da Vinci Mona Lisa	Wiederholung der Mona L Seminar Dachs uni-wien	Wiederholung der Mona L Seminar Dachs uni-wien
				



Home Bilder Arbeitsmappen uni-marburg

Treffer 18 / 49

Pool: Wechsel im Connector-Modus nicht möglich

Suchen Erweiterte Suche in Ergebnis

Mona Lisa

0 / 0 / 49 Standard

Künstler Leonardo da Vinci
Vinci, Leonardo da
Maler, Bildhauer, Architekt, Bühnenbildner, Kostümbildner, Zeichner, Kartograph, Techniker, Ingenieur, Naturforscher — Italien, *1452 Vinci, + 1519, 05.02 Cloux (Amboise) — tätig in: Florenz, Mailand, Mantua, Venedig, Rom, Cloux (Amboise), 1467-1519

Herstellort

Titel Mona Lisa

Datierung 1502

Epoche

Standort > Frankreich > Paris
Musée National du Louvre

Fundort

Technik Öl auf Holz

Maße 77 x 53 cm

Gattung > Tafelmalerei > Bild > Porträtmalerei

Ikonomie

Pool Diathek

Abb.-Nachweis Gombrich, E.H.: Die Geschichte der Kunst. 16. Ausg. Frankfurt a. M. 1996. Abb. 193.

Copyright

Kommentar

Interne ID 57665

Morimura, Yasumasa
Mona Lisa in its Pregnanc...

Morimura, Yasumasa
Mona Lisa in its Origin

Salai, Safet; Leonardo da
Mona Lisa

Leonardo da Vinci (nach)
Mona Lisa

Leonardo da Vinci (nach)
Mona Lisa

Leonardo da Vinci (nach)
Mona Lisa, Modifikation

Leonardo da Vinci (nach)
T-Shirt, Leonardo da Vinc...

Leonardo da Vinci
Mona Lisa, Detail

Leonardo da Vinci
Mona Lisa, Detail

Leonardo da Vinci
Mona Lisa, Detail

Polke, Sigmar
Mona Lisa

Duchamp, Marcel
L.H.O.O.Q. (Kopie von 19...

Duchamp, Marcel
From or by Marcel Duchamp...

Rauschenberg, Robert
Ohne Titel (Mona Lisa)

Leonardo da Vinci
Mona Lisa

Wiederholung der Mona L
Seminar Dachs uni-wien

Wiederholung der Mona L
Seminar Dachs uni-wien

William Vaughan, „Computer-gestützte Bildanalyse und Bildrecherche“, in *Kunstgeschichte digital*, ed. Hubertus Kohle (Berlin, 1997) 97–106; Wolfgang Ernst and Stefan Heidenreich (eds.), *Suchbilder. Visuelle Kultur zwischen Algorithmen und Archiven* (Berlin, 2003); Jacques Thuiller, “L’informatique en histoire de l’art: où en sommes-nous? (Editorial)”, in: *Revue de l’art* 97, 1992, 5–10; James Cuno, “How Art History Is Failing in the Internet”, in: *The Daily Dot*, <https://www.dailydot.com/via/art-history-failing-internet/>



Archaeological image databases

A current list of archaeological image databases is provided by Heidelberg University Library:

<http://www.ub.uni-heidelberg.de/fachinfo/archaeologie/Welcome.html>

[http://rzblx10.uni-regensburg.de/dbinfo/dbliste.php?dbt=16&bib_id=ubhe&colors=15
&ocolors=40&lett=f&sort=type&gebiete=27#BILDDATENBANK](http://rzblx10.uni-regensburg.de/dbinfo/dbliste.php?dbt=16&bib_id=ubhe&colors=15&ocolors=40&lett=f&sort=type&gebiete=27#BILDDATENBANK)



Web-based image databases for art

Pioneers of the 1990s:

- Art Renewal Center (<http://www.artrenewal.org>)
- Web Gallery of Art (<http://www.wga.hu>)
- CGFA (<http://www.cgfaonlineartmuseum.com>)
- The Athenaeum (<http://www.the-athenaeum.org>)
- Artcyclopedia (<http://www.artcyclopedia.com>)

Current Positions:

<http://kunstgeschichte.info/media/tools/kunsthistorische-bilddatenbanken/>

- Google Art Project (<https://www.google.com/culturalinstitute/project/art-project?hl=de>)

Examples of collection catalogues of larger museums:

- Metropolitan Museum New York (<http://www.metmuseum.org/collection>)
- MFA Boston (<http://www.mfa.org/collections/mfa-images>)





British Museum Collection online

Images only

[+ Advanced search options](#)

Welcome to the updated collection search. The entire database can be searched here and new records and images are added every week.

There are currently 2,163,928 records available, which represent more than 3,500,000 objects. 868,308 records have one or more images.

Last updated: 27 December 2014.

[How to use this search >](#)

Share this page



[Kanga: textiles from Africa >](#)



[Paintings from the tomb chapel of Nebamun >](#)



[Objects from the Roman cities of Pompeii and Herculaneum >](#)



[Objects excavated from the Anglo-Saxon ship-burial at Sutton Hoo >](#)



[Chinese ceramics from the Sir Percival David collection >](#)



[The Mildenhall Treasure from Roman Britain >](#)



British Museum

Semantic web version

„British Museum collection data is available in the W3C open data standard, RDF, joining and relating to a growing body of linked data published around the world.“

http://www.britishmuseum.org/research/collection_online/about_the_database.aspx

Research > Collection >

Collection online

Bobbin

Images only

kylix

[Back to](#)

Object type **kylix**

Museum number 1864,1007.91

Description Pottery: red-figured kylix.
Interior: Within a circle composed of single maeanders interspersed with six red cross squares, a woman seated to right in a chair, holding up in her right a mirror; in her left some oviform object, probably part of her beauty regime. She wears a sleeved chiton with himation over it; her hair falling on

Culture/period **Attic**

Date 470BC (circa)

Production place **Made in: Attica**; (Europe,Greece,Attica)

Findspot **Excavated/Findspot: Fikellura Cemetery, Tomb 252**; (Europe,Greece,Dodecanese,Rhodes,Fikellura Cemetery (Kamiro))

Materials **pottery**

Ware **Red figure**

Technique **painted**

Dimensions Height: 10.16 centimetres
Diameter: 21.59 centimetres

Curator's comments **BM Cat. Vases**
Found in tomb with 'alabastos, 3 kylikes with black ornaments, glass phiale, blue, yellow, and green, 3 terra cotta female statuettes, a terra cotta bird, a terra cotta vessel (cover, red with brown bands), 2 terra cotta dolls, a terra cotta spindle ring.'

Bibliography **Vase E87**

Condition Several parts missing; foot restored.

Acquisition name **Excavated by: Auguste Salzmann**
Excavated by: Sir Alfred Biliotti

Acquisition date 1864

Department Greek & Roman Antiquities

Registration number 1864,1007.91



Image service:
[Use image >](#) [Request new photo >](#)

Recommend



Keywording / Ontologies

- ICONCLASS (<http://www.iconclass.nl>)
- Marburger Inventarisations-, Dokumentations- und Administrations-System (MIDAS, <http://www.fotomarburg.de>)
- Getty Vocabulary (<http://www.getty.edu/research/tools>)
- Art and Architecture Thesaurus (AAT, <http://www.getty.edu/research/tools/vocabularies/aat/>)
- Vokabular in der Museumsdokumentation des Deutschen Museumsbundes (www.museumsvokabular.de)

s. Regelwerke, Thesauri, Klassifikationen, Systematiken und Begriffslisten. Eine kommentierte Linksammlung des Team MusIS im Bibliotheksservice-Zentrum Baden-Württemberg (<https://wiki.bsz-bw.de/doku.php?id=mare-team:museums-archivsysteme:musis:links:thesauri>)



Kerameikos.org

Kerameikos.org is a collaborative project dedicated to defining the intellectual concepts of pottery following the tenets of linked open data and the formulation of an ontology for representing and sharing ceramic data across disparate data systems. While the project is focused primarily on the definition of concepts within Greek black- and red-figure pottery, Kerameikos.org is extensible toward the definition of concepts in other fields of pottery studies.

See the github account at <https://github.com/kerameikos>, which contains repositories for the RDF data and the publication framework. This framework could be applied to other linked data thesauri.

Scientific Committee

The scientific committee includes both pottery and cultural heritage informatics experts.

- Vladimir Alexiev, Ontotext
- Renee Gondek, University of Mary Washington
- Ethan Gruber, American Numismatic Society
- Thomas Mannack, Oxford University
- Tyler Jo Smith, University of Virginia
- Anne-Violaine Szabados, Lexicon Iconographicum Mythologiae Classicae (LIMC-France)

Support



In August 2018, the [National Endowment for the Humanities](#) awarded Kerameikos \$85,382 as part of the Digital Humanities Advancement program. An 18-month long Level II project, this will fund the creation of all necessary Archaic and Classical Greek pottery concepts the building of various aggregation or data harvesting tools.

Collaborators



The [Institute for Advanced Technology in the Humanities](#) at the University of Virginia hosts Kerameikos.org.



The [Beazley Archive](#), Classical Art Research Center. University of Oxford has provided the



RDF (Resource Description Framework) Data for the Attic potter Exekias

```
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF xmlns:dc="http://purl.org/dc/terms/" xmlns:nm="http://nomisma.org/id/"
  xmlns:cc="http://creativecommons.org/ns#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:rdfa="http://www.w3.org/ns/rdfa#"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#"
  xmlns:geo="http://www.w3.org/2003/01/geo/wgs84_pos#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:foaf="http://xmlns.com/foaf/0.1/>
```

...



```

<ecrm:E53_Place xmlns:ecrm="http://erlangen-crm.org/current/"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:foaf="http://xmlns.com/foaf/0.1"
  xmlns:osgeo="http://data.ordnancesurvey.co.uk/ontology/geometry/"
  rdf:about="http://kerameikos.org/id/attica">
  <rdf:type rdf:resource="http://www.w3.org/2004/02/skos/core#Concept"/>
  <skos:prefLabel xml:lang="en">Attica</skos:prefLabel>
  <skos:prefLabel xml:lang="de">Attika</skos:prefLabel>
  <skos:prefLabel xml:lang="pl">Attyka</skos:prefLabel>
  <skos:prefLabel xml:lang="zh">阿提卡</skos:prefLabel>
  <skos:prefLabel xml:lang="ru">Аттика</skos:prefLabel>
  <skos:prefLabel xml:lang="fr">Attique</skos:prefLabel>
  <skos:prefLabel xml:lang="pt">Ática</skos:prefLabel>
  <skos:prefLabel xml:lang="ja">アッティカ</skos:prefLabel>
  <skos:prefLabel xml:lang="it">Attica</skos:prefLabel>
  <skos:prefLabel xml:lang="sv">Attika</skos:prefLabel>
  <skos:prefLabel xml:lang="es">Ática</skos:prefLabel>
  <skos:prefLabel xml:lang="nl">Attika</skos:prefLabel>
  <skos:definition xml:lang="en">Attica is an historical region that encompasses the city of Athens, the capital of Greece.</skos:definition>
  <skos:exactMatch rdf:resource="http://pleiades.stoa.org/places/579888"/>
  <skos:exactMatch rdf:resource="http://dbpedia.org/resource/Attica"/>
  <skos:exactMatch rdf:resource="http://vocab.getty.edu/tgn/7593167"/>
  <skos:exactMatch rdf:resource="http://collection.britishmuseum.org/id/place/x30950"/>
  <geo:location rdf:resource="http://kerameikos.org/id/attica#this"/>
</ecrm:E53_Place><geo:SpatialThing xmlns:ecrm="http://erlangen-crm.org/current/"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:foaf="http://xmlns.com/foaf/0.1"

```



```

<kon:Technique xmlns:ecrm="http://erlangen-crm.org/current/"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:kon="http://kerameikos.org/ontology#"
  xmlns:kid="http://kerameikos.org/id/"
  rdf:about="http://kerameikos.org/id/black\_figure">
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  <skos:prefLabel xml:lang="nl">Zwartfigurige stijl</skos:prefLabel>
  <skos:prefLabel xml:lang="sv">Svartfigurig keramik</skos:prefLabel>
  <skos:prefLabel xml:lang="pt">Registro de pintura negra em cerâmica grega</skos:prefLabel>
  <skos:prefLabel xml:lang="ru">Чернофигурная вазапись</skos:prefLabel>
  <skos:prefLabel xml:lang="es">Cerámica de figuras negras</skos:prefLabel>
  <skos:prefLabel xml:lang="de">Schwarzfigurige Vasenmalerei</skos:prefLabel>
  <skos:prefLabel xml:lang="pl">Styl czarnofigurowy</skos:prefLabel>
  <skos:prefLabel xml:lang="it">Ceramica a figure nere</skos:prefLabel>
  <skos:prefLabel xml:lang="zh">黑彩陶器</skos:prefLabel>
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  <skos:exactMatch rdf:resource="http://dbpedia.org/resource/Black-figure\_pottery" />
  <skos:exactMatch rdf:resource="http://collection.britishmuseum.org/id/thesauri/x14736" />

  <skos:exactMatch rdf:resource="http://vocab.getty.edu/aat/300387209" />
</kon:Technique>

```



```
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  <rdf:type rdf:resource="http://www.w3.org/2004/02/skos/core#Concept" />
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    <skos:prefLabel xml:lang="pt">Exéquias</skos:prefLabel>
    <skos:prefLabel xml:lang="sv">Exekias</skos:prefLabel>
    <skos:prefLabel xml:lang="es">Exequias (pintor)</skos:prefLabel>
    <skos:prefLabel xml:lang="fr">Exékias</skos:prefLabel>
    <skos:prefLabel xml:lang="de">Exekias</skos:prefLabel>
    <skos:definition xml:lang="en">Exekias (Ancient Greek: Ἐξηκίας, Exēkías) was an ancient Greek vase-painter and potter who was active in
Athens between roughly 545 BC and 530 BC.</skos:definition>
    <skos:exactMatch rdf:resource="http://collection.britishmuseum.org/id/person-institution/58234/" />
    <skos:exactMatch rdf:resource="http://dbpedia.org/resource/Exekias/" />
    <skos:exactMatch rdf:resource="http://viaf.org/viaf/57427027/" />
    <skos:exactMatch rdf:resource="http://viaf.org/viaf/4245236/" />
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    <skos:exactMatch rdf:resource="http://d-nb.info/gnd/119536366/" />
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    <skos:exactMatch rdf:resource="http://vocab.getty.edu/ulan/500027430/" />
```

Image meta search

- Indexing / search via metadata such as keywords or links (attribution, hierarchisation, linked data, image paths etc.)





Content Based Image Retrieval (CBIR)

Indexing via visual content such as colour, texture, shapes etc.



Athens, Parthenon

- Semantic Retrieval
e.g. the query "Find pictures of the Parthenon".
-> Database-driven comparison of texture, colour and shape.
In fact, retrieving images as a *higher-level concept* still requires human feedback
- Relevance feedback (human interaction) by marking images in the results as "relevant", "not relevant" or "neutral" to the search query


Vipin Tyagi, *Content-Based Image Retrieval. Ideas, Influences, and Current Trends* (Heidelberg: Springer, 2017)



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<http://tineye.com>


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TinEye

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for file: Parthenon_540.png

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- Oldest



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3

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[Compare](#) | [Link](#)

JPEG Image
300x225, 21.8 KB




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[parthenon2.gif](#)
[www.hkedcity.net/article/resources_ki...](#)

Crawled on 2008-04-17

[Compare](#) | [Link](#)

IPFG Image



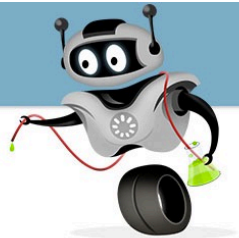
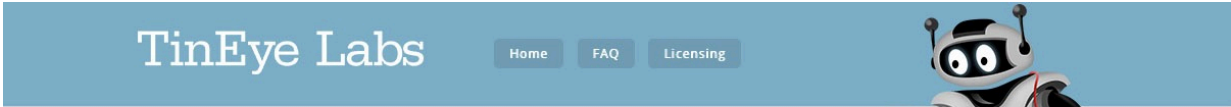
58



TinEye Labs

<http://labs.tineye.com>

Search 20 million Creative Commons images from Flickr by color



Multicolor Search Lab powered by MulticolorEngine

We extracted the colors from 20 million Creative Commons images on Flickr to make the images searchable by color. Enjoy! MulticolorEngine is addictive and very likely the best color search engine in the world*!



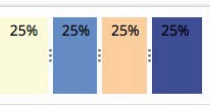
Step 1

Select up to 5 colors



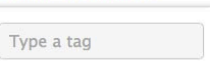
Step 2

Slide dividers to adjust color composition



Step 3

Add tags to refine your results



« Previous 1 ... Next »

20,009,774 images provided by Flickr.
This demo is not endorsed or certified by Flickr.

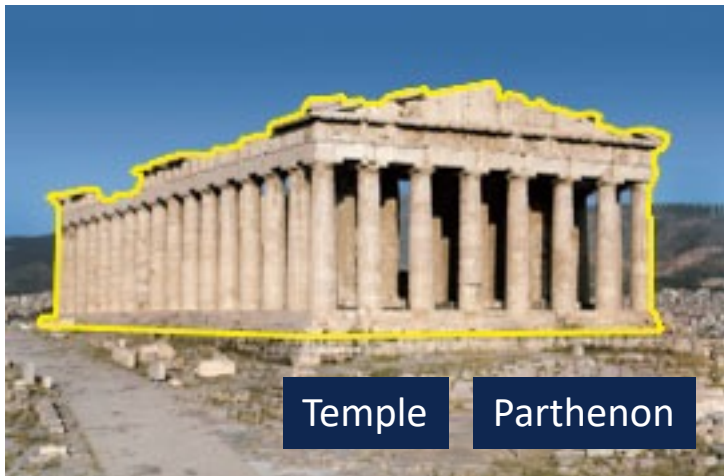
* Forgive us, we are biased.



Automatic Image Annotation

(also: *Automatic Image Tagging* or *Linguistic Indexing*)

automatically assigns metadata in the form of subtitles or keywords to a digital picture.



- Machine learning technique that uses extracted feature vectors and training annotations to automatically apply annotations to new images.
- a kind of classification for several (very many) classes that matches the text vocabulary with the "visual vocabulary" via relevance models.

https://en.wikipedia.org/wiki/Automatic_image_annotation



Automatic image recognition through annotation



Road Lines



Cubes

<https://gist.github.com/bigsnarfdude/d811e31ee17495f82f10db12651ae82d>



Image annotation: Bounding Boxes and Full Segmentation



Lists with Image Annotation Tools: https://en.wikipedia.org/wiki/List_of_manual_image_annotation_tools

<https://gengo.ai/articles/image-annotation-tools-for-computer-vision/>

<https://hackernoon.com/the-best-image-annotation-platforms-for-computer-vision-an-honest-review-of-each-dac7f565fea>





VGG Image Annotator (VIA)

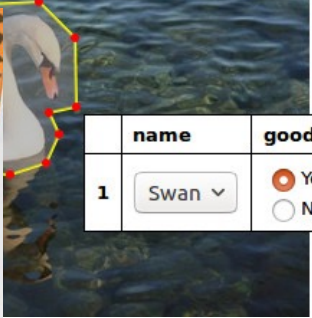
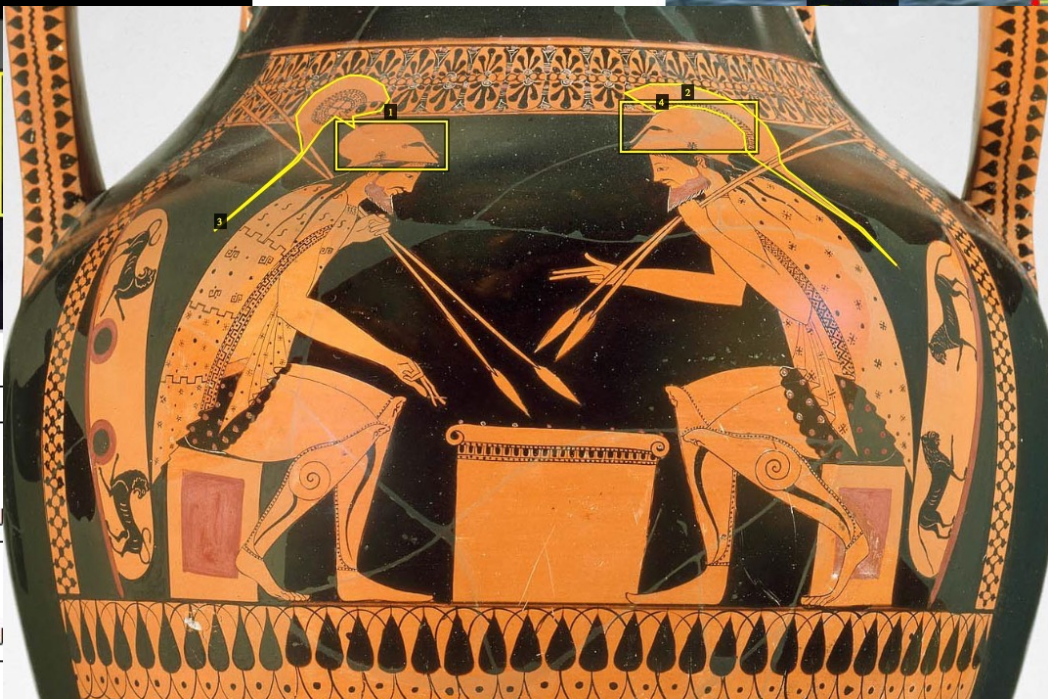
<http://www.robots.ox.ac.uk/~vgg/software/via/>

Home Project Annotation View Help



Region Annotations File Annotations

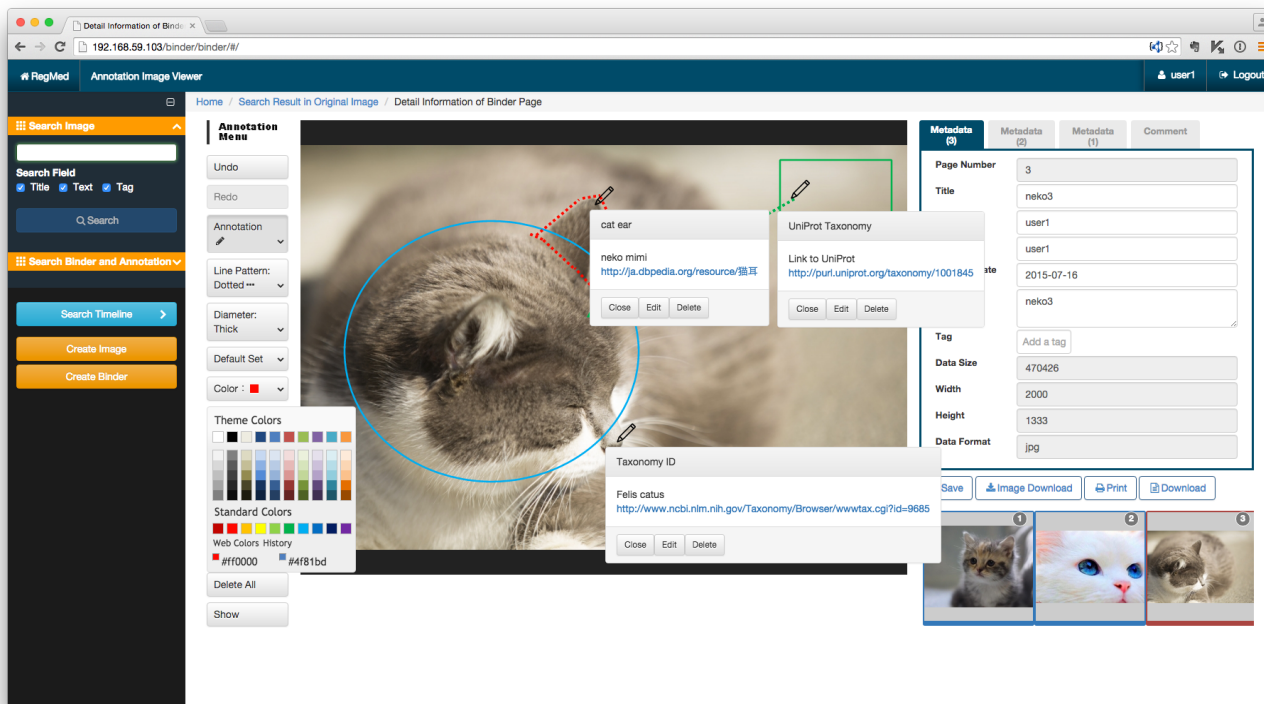
	name	
1	 Benedict Cumberbatch	 Martin Freeman
2	 Benedict Cumberbatch	 Martin Freeman

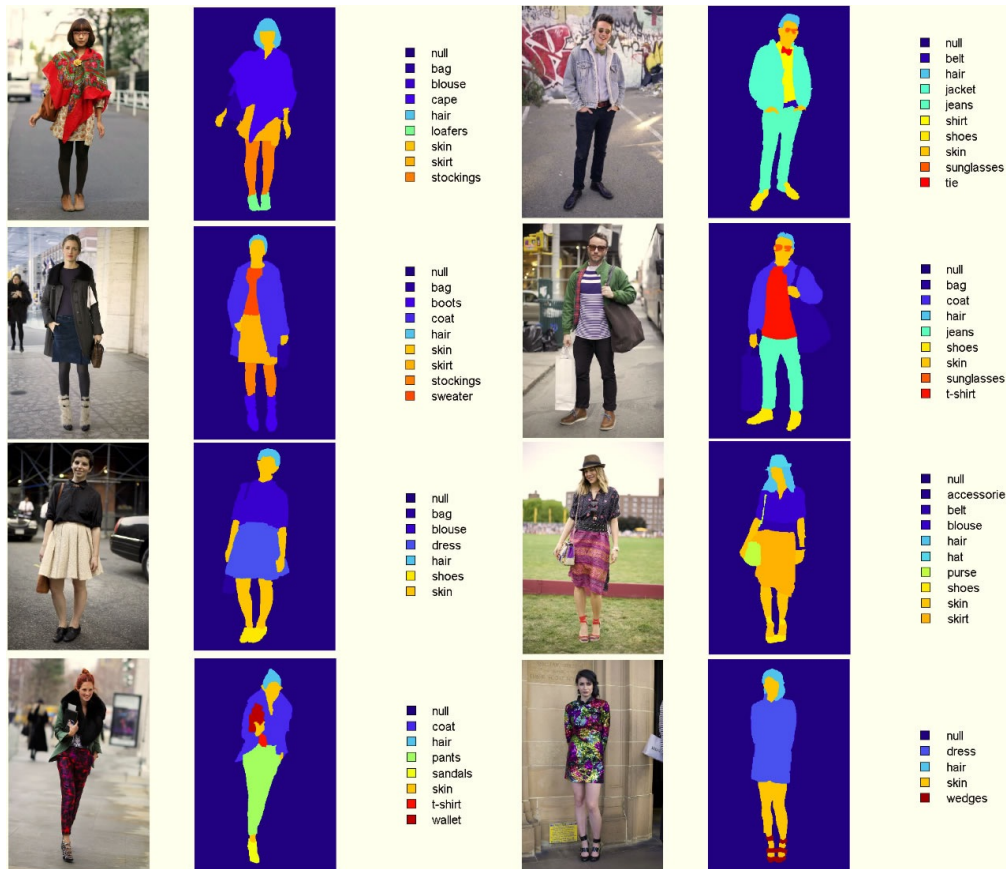


	name	good
1	Swan	<input checked="" type="radio"/> Yes <input type="radio"/> No

OpenIAV (Image Annotation Viewer)

<https://regmed.hgc.jp/aiv.html>





MATLAB Computer Vision Toolbox

<https://de.mathworks.com/products/computer-vision.html>



21

Halsornament	Inschriften	Mittelmotiv	Faktor Symmetrie	Bildmitte	Deckfarbe	Besonderheit
Lotos-Palmetten-Kette	ACHILLEOS, Ausspruch	0	95,65	Inschriften	0	

Helm1

Sichelform
auf Kopf

Schild1

böotischer Schild
angelehnt

Schildzeichen

Maske

Brustpanzer1

Mantel1

Webmuster

Speere1

Doppelspeer
45° in der Hand

Beinschienen1

Gravur

Kopfhaltung1

gesenkt

Körperhaltung1

vorgebeugt

Sitzhaltung1

auf Kante, Beine 45°

Helm2

Sichelform
auf Schild

Schild2

böotischer Schild
angelehnt

Schildzeichen2

Maske

Brustpanzer2

Mantel2

Webmuster

Speere2

Doppelspeer
45° in der Hand

Beinschienen2

Gravur

Kopfhaltung2

gesenkt

Körperhaltung2

vorgebeugt

Sitzhaltung2

auf Kante, Beine 45°

Arm1

angewinkelt, Speere

Hand1

geschlossen

rechts

135°

am Brett

Kopf / Körper / Arm

0 gerade n.l.

0 gerade

0 H V

rechts

135°

am Brett

links

angewinkelt, Speere

Hand2

geschlossen

Beifigur links

0

Hocker1 Block

Spieltisch Block+Brett

Spielsteine 0

BeifigurRechts

0



The advantage of automatic image annotation over content based image retrieval (CBIR) is that queries can be entered textually. However, in ignorance of the training data, the results are not always comprehensible.

Google Images

<https://images.google.com>

The screenshot shows a Google Images search for 'parthenon'. The search bar contains the text 'parthenon'. Below the search bar are navigation tabs for 'Alle', 'Bilder', 'Maps', 'Videos', 'News', 'Mehr', 'Einstellungen', and 'Tools'. There are also filters for 'Sammlungen' and 'SafeSearch'. Below the navigation are several filter buttons: 'nashville', 'nashville tennessee', 'athens greece', 'greek', 'acropolis', 'akropolis', 'centennial park', 'facts', 'parthenon nashville tn', 'columns', 'parthenon tempel', 'athena parthenos', 'architecture', and 'britli'. The main area displays a grid of 18 image thumbnails, each with a small caption and source URL. The thumbnails show various views of the Parthenon, including the full temple, close-ups of columns, and reconstructions. The captions and URLs are as follows:

- Parthenon | History & Facts | Britannica.c...
britannica.com
- Parthenon - Wikipedia
de.wikipedia.org
- Parthenon - Wikipedia
en.wikipedia.org
- Visit Greece | Parthenon
visitgreece.gr
- Parthenon in Nashville, Tennessee, V...
travel.nygc.com
- Parthenon - Ancient History Encyclopedia
ancient.eu
- Nashville > Parks and Recreation > Parth...
nashville.gov
- Die Geschichte von Parthenon, 2.500 J...
itihari.com
- Parthenon, Aktivitäten 2019 – Viator
viator.com
- Parthenon - Akropolis Athen
akropolis.gr
- Sieckbrief für den Parthenon Tempel ...
poliskultur.de
- Parthenon
ancient-greece.org
- Parthenon Nashville History and Informat...
trolleytours.com
- 10 Fun Facts About the Acropolis & ...
nuventuretravels.com
- Good time to visit or revisit the Parthenon
tennessean.com
- Parthenon | Assassin's Creed Wiki | FANDO...
assassinscreed.fandom.com
- The Parthenon - World History
worldhistory.us
- On this day on 1687: A direct hit by a V...
telegraph.co.uk



Pixolution

<https://pixolution.org>

In the meantime
chargeable

The screenshot shows the Pixolution search interface. At the top left is the Pixolution logo. To its right is a search bar containing the text "parthenon" and a magnifying glass icon. Further right is a small thumbnail image of the Parthenon. Below the search bar is a dark grey navigation bar with the following statistics: "3 098 Images found", "30 ms", "10% by keywords", and "90% visually". On the far right of this bar is a button that says "Test with your images" with a right-pointing arrow. Below the navigation bar is a grid of 18 image thumbnails showing various views and states of the Parthenon, including some under construction or restoration.






Incogna






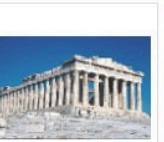
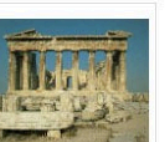




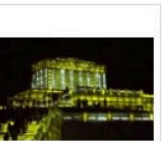
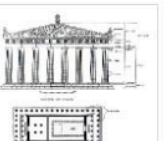
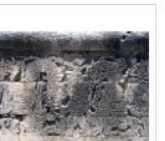


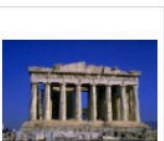

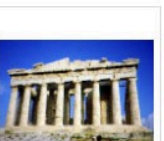
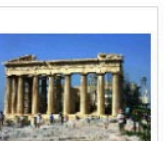

<http://www.incogna.com>


Closed in 2018 due to data-mining attacks

Product Search Platform Enterprise Computer Vision [Sign in](#) | [Careers](#) | [About Incogna](#) | [Help](#)

 parthenon

Click  to return to your initial search Results 1 - 21 of 494 for  (0.13 seconds)

History  1 2 3 4 5 6 7 8 9 10 . [Next Page](#)



TinEye Similarity search via „most changed“

<http://tineye.com>

TinEye

59,69 Searched
Mona_Lis

Using Tin non-com

Show onl
 1,065
 448

Sort by most changed

- Best match
- Most changed
- Biggest image
- Newest
- Oldest

183rea
magazine
Filename:

183rea
magazine
Filename:

1stweb
inspiratio
wp-conte
Filename:

20qu.ci
jingxuan/
jingxuan/
Filename:

forum.211.ru

Compare match Close

JPEG, 460x663, 98.6 KB

Your image Compare Image match



Discussion of the methods of digitisation

ANNOTATION

Controlled vocabularies,
taxonomies, ontologies
(expert knowledge)

- + accurate
- + highly structured
- + schema-consistent
- + transparent
- + good for small amounts of data with many dimensions of meaning
- expensive
- dependent on perception
- comparatively slow
- not good with large amounts of data



ARTigo and Crowd Sourcing

<http://www.artigo.org>

EN DE FR

IMPRESSUM REGISTRIEREN LOGIN

ARTigo

ÜBER ARTIGO

BLOG / /

ZUR BESTENLISTE

Runde 1 von 5

18 Sekunden

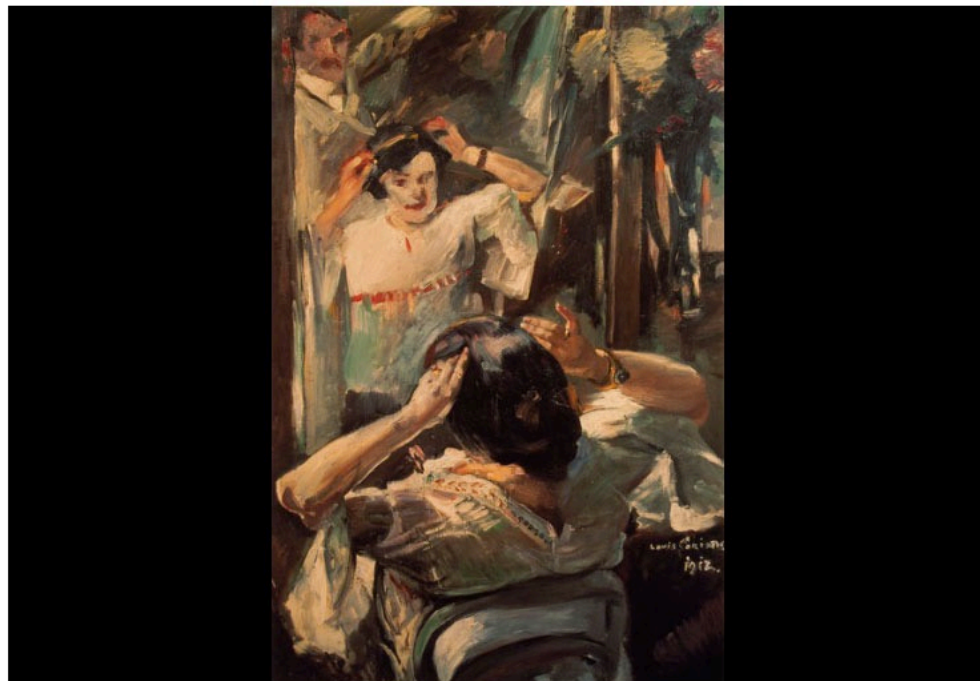
PUNKTE 5

SCHLAGWORTE DES MITSPIELERS 11

EINGEGEBENE SCHLAGWORTE SPIEGEL 0
SPIEGEL 5

Eingabe

Suche





Discussion of the methods of digitisation

PATTERN RECOGNITION

Statistical and probabilistic models (data mining, image analysis, natural language processing, ...)

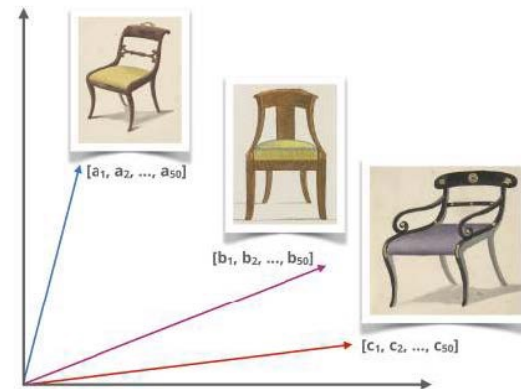
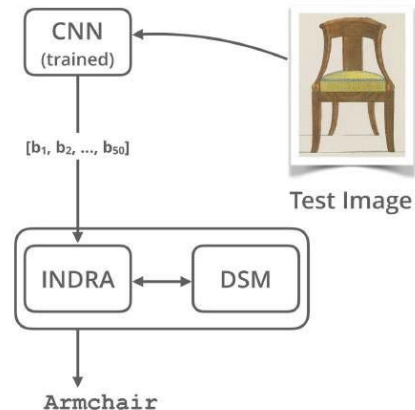
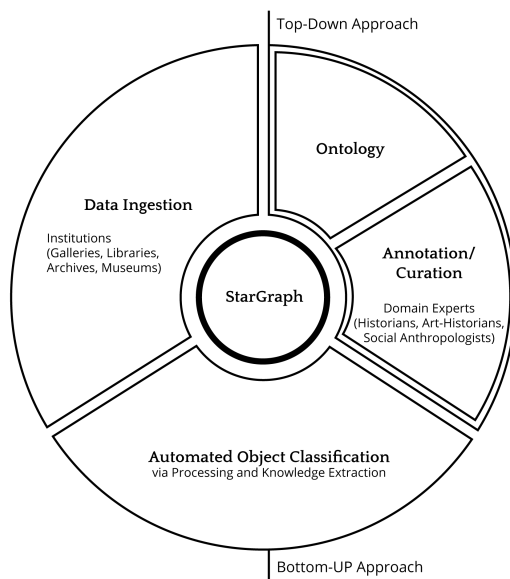
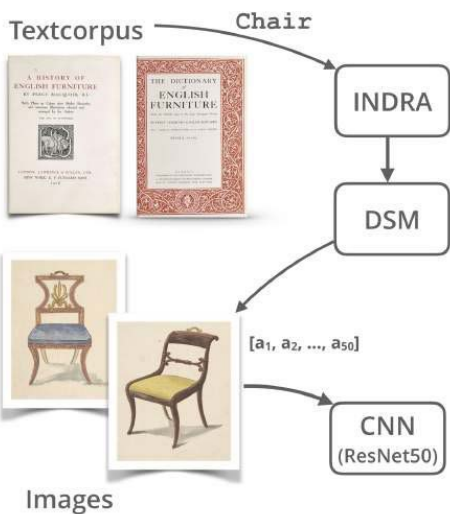
- + automated
- + fast
- + inexpensive
- + large amounts of data
- + process-consistent
- + reproducible

- non-transparent (black-box)
- correlations, not causality
- only good for large amounts of data
- expects uniform distribution of characteristics



Neoclassica

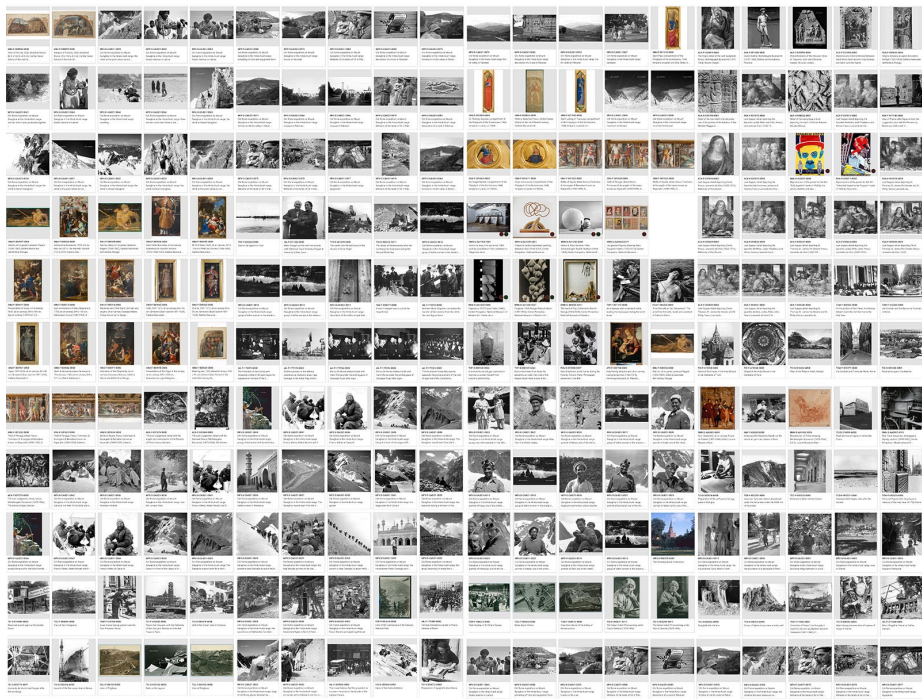
<https://neoclassica.fim.uni-passau.de>



Simon Donig u.a., Vom Bild zum Text und wieder zurück, Digital Humanities im deutschsprachigen Raum 2019, 227–232 (<https://neoclassica.fim.uni-passau.de/wp-content/uploads/Neoclassica-2019-DHd-2019-Digital-Humanities-multimedial-multimo.pdf>)



Corpus formation remains an important goal



CHALLENGES IN DEALING WITH THE DIGITAL IMAGE

- Capturing and indexing pictorial works in accordance with the image
- critical, reflective handling of visual phenomena and their fluidity
- Theory of the digital image and the manifestations of the Digital Turn



- Basics of information visualisation
- Basic understanding of the properties of graphics (image size, resolution, colour depth, colour space, compression, transparency, layers etc.)
- File formats for storing pictorial information and their differences
- Current positions on the concept of the image and its relevance for the humanities
- Possibilities of textual marking and visual annotation of images
- Relevance of metadata in (and to) image files



- Selection of suitable graphic formats for different usage scenarios and long-term archiving
- Editing digital images (sizing, manipulation, cropping, working with multiple layers and suitable saving) using an image editing program
- Use of automatic batch processing for similar process steps (size, format, resolution, tags, metadata, XMP etc.)



What is referred to as "image size" in computer graphics?

Slide 15

Which possibilities do you know for image-based data search?

Slide 57–60. 67–70

What is a digital image? What properties does it have and what effects does it have?

Slide 26–42

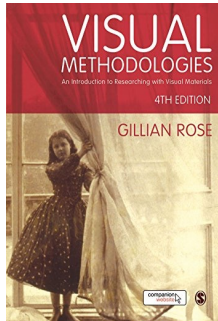
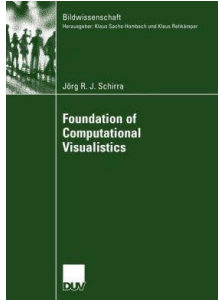
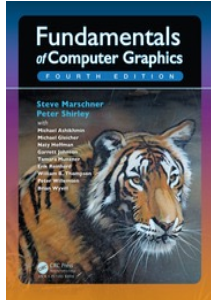
What is meant by Iconic Turn? What part does the computer play in this development?

Slide 2–7

Which file format would you use for a printed publication, which for an image database? Please give reasons for your answer.

Slide 23

What differences do you see between text and image data?



Steve Marschner, Peter Shirley, *Fundamentals of Computer Graphics*, 4th ed. (A K Peters/CRC Press 2015)

Jörg R. J. Schirra, *Foundation of Computational Visualistics* (DUV, 2005)

W.J.T. Mitchell, *What do Pictures Want? the Lives and Loves of Images*. (Chicago: University Press, 2005)

Gillian Rose, *Visual Methodologies: An Introduction to Researching with Visual Materials*, 4. Auflage (SAGE Publications Ltd, 2016).

Jason Gaiger, "The Idea of a Universal Bildwissenschaft". in: *Estetika. The Central European Journal of Aesthetic* 41, 2014, 208–229

Folie 2: http://www.mac-history.de/wp-content/uploads/2008/05/mac_early_gui.gif;
<https://www.cnet.de/88160022/30-jahre-microsoft-windows-die-entwicklung-von-1985-2015-in-bildern/>

Folie 3: www.telegraph.co.uk/technology/internet/10663451/The-early-days-of-25-websites.html

Folie 4:
http://upload.wikimedia.org/wikipedia/commons/thumb/8/8e/Duerer_-_Ritter%2C_Tod_und_Teufel_%28Der_Reuther%29.jpg/1200px-Duerer_-_Ritter%2C_Tod_und_Teufel_%28Der_Reuther%29.jpg;
http://upload.wikimedia.org/wikipedia/commons/thumb/4/42/Hermann_Krone_-_Selbstportr%C3%A4t_in_seinem_Atelier_%28um_1858%29.jpg/1200px-Hermann_Krone_-_Selbstportr%C3%A4t_in_seinem_Atelier_%28um_1858%29.jpg

Folie 5: www.ifbb-hannover.de/de/bildgebende-verfahren-und-optische-analytik.html

Folie 6: www.universalleonardo.org/; <http://vangoghletters.org/>;
www.romereborn.org/sites/default/files/Big-city-image-for-web_full.png;
<https://de.maps-rome.com/img/0/3d-karte-des-antiken-rom.jpg>

Folie 9:
https://lh3.googleusercontent.com/proxy/2jmR4lav3IUlvSzBmK0S7rdx6YC0nBurMS3JMaJtTUQaeakQZQl8xuW0htQyCGLnxf5XobHtDi5B5kh4_nl6sUCGIF0bTTHcjUAA3106EN6gU3yRe6p3qmvN29v2dQ

Folie 10: © Digitalisierungszentrum SUB Göttingen

Folie 11:
http://upload.wikimedia.org/wikipedia/commons/3/3d/DPI_and_PPI.png

Folie 16:
https://upload.wikimedia.org/wikipedia/commons/f/ff/Umbrella_Nearest_Neighbor.png

Folie 19: http://en.wikipedia.org/wiki/Color_space

Folie 33: www.behance.net/gallery/59879715/SET-OF-GIFS-3

Folie 34. 35: <https://gizmodo.com/russian-state-tv-photoshops-an-awkward-smile-on-kim-jon-1826529277>;
<https://pics.astrologymemes.com/a-rare-photo-of-president-lincoln-with-his-iphone-that-48807115.png>

Folie 38: <http://assets-global.viveport.com/media/catalog/product/cache/454fd02112eda305396a11ce78d827e5/1/8/18d91af1-9fa5-4ec2-959b-4f8161064796.753e71c3.png>

Folie 44. 45: <http://easydb.sub.uni-goettingen.de/>

Folie 47: <http://www.wga.hu>

Folie 48:
http://www.britishmuseum.org/research/collection_online/search.aspx

Folie 49:
http://www.britishmuseum.org/collection/object/G_1864-1007-91

Folie 51: <http://kerameikos.org>

Folie 56:

http://upload.wikimedia.org/wikipedia/commons/0/08/Bag_of_words.JPG

Folie 57: <http://www.visitgreece.gr/en/culture/monuments/parthenon>

Folie 58, 59, 70: <http://tineye.com>

Folie 61:

<http://gist.github.com/bigsnarfdude/d811e31ee17495f82f10db12651ae82d>

Folie 63: <http://www.robots.ox.ac.uk/~vgg/software/via/>

Folie 64: <http://regmed.hgc.jp/aiv.html>

Folie 65: <http://github.com/bearpaw/clothing-co-parsing/blob/master/README.md>

Folie 67: <http://images.google.com>

Folie 68: <http://pixolution.org> (7.11.2016)

Folie 69: www.incogna.com (7.11.2016)

Folie 75: www.amazon.de

Die angegebenen Websites wurden zuletzt am 1.3.2020 aufgerufen. Die Vorlage für die vielfältigen Bearbeitungen der "Mona Lisa":

https://en.wikipedia.org/wiki/Mona_Lisa#/media/File:Mona_Lisa,_by_Leonardo_da_Vinci,_from_C2RMF_retouched.jpg

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