Digital Graffiti-scape Archaeology

Geert Verhoeven | *project coordinator*
projectindigo.eu

The INDIGO graffiti project was funded by the Heritage Science Austria programme of the Austrian Academy of Sciences (ÖAW)

iconic

GRAFFITI

diverse creations

iconic

GRAFFITI
diverse creations

multi-faceted

GRAFFITI
diverse creations

art <> vandalism

graphical <> textual

socio-political criticism <> entertaining

legal <> illegal

tangible <> intangible

multi-faceted

GRAFFITI
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art <> vandalism

graphical <> textual

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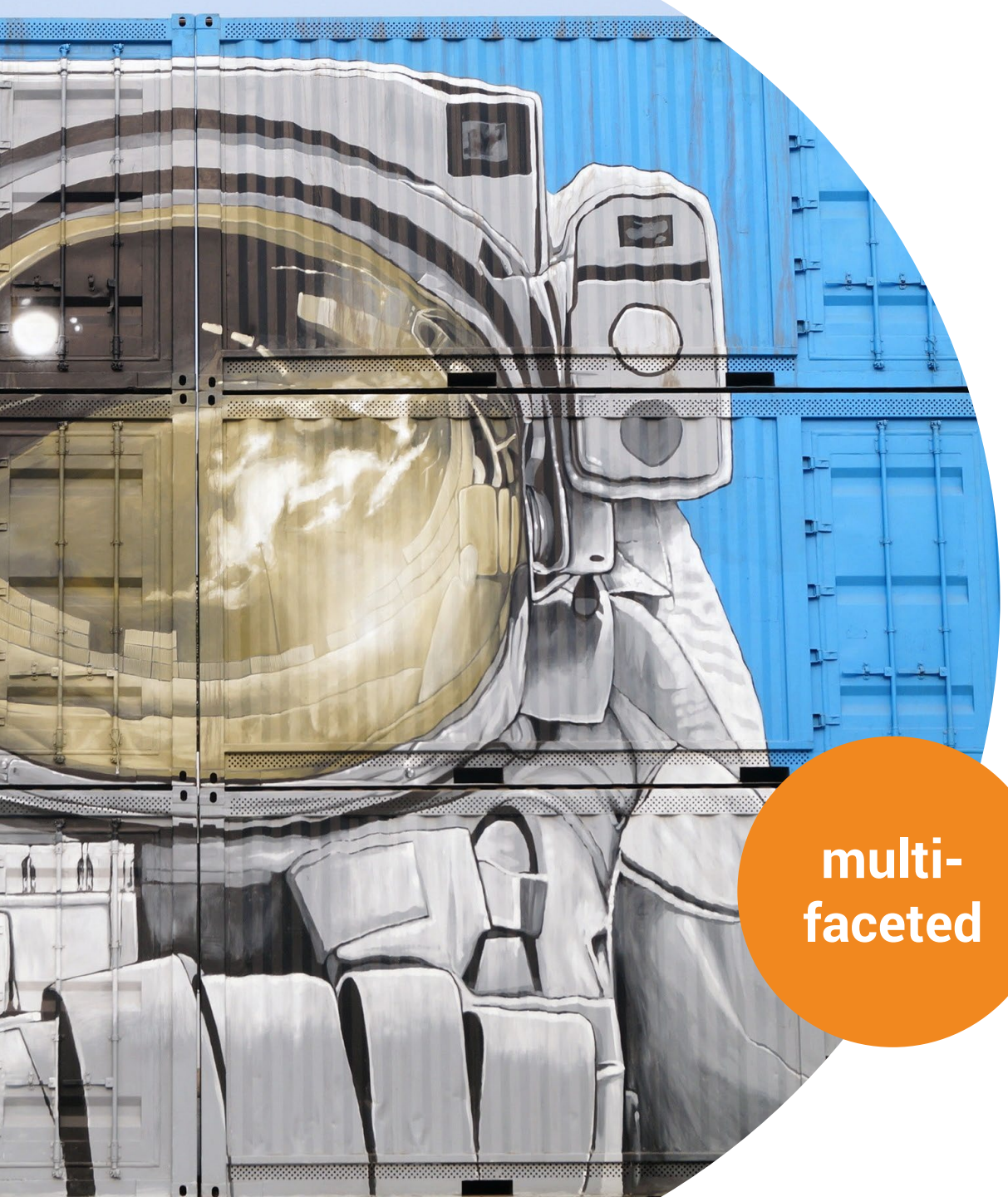

multi-faceted

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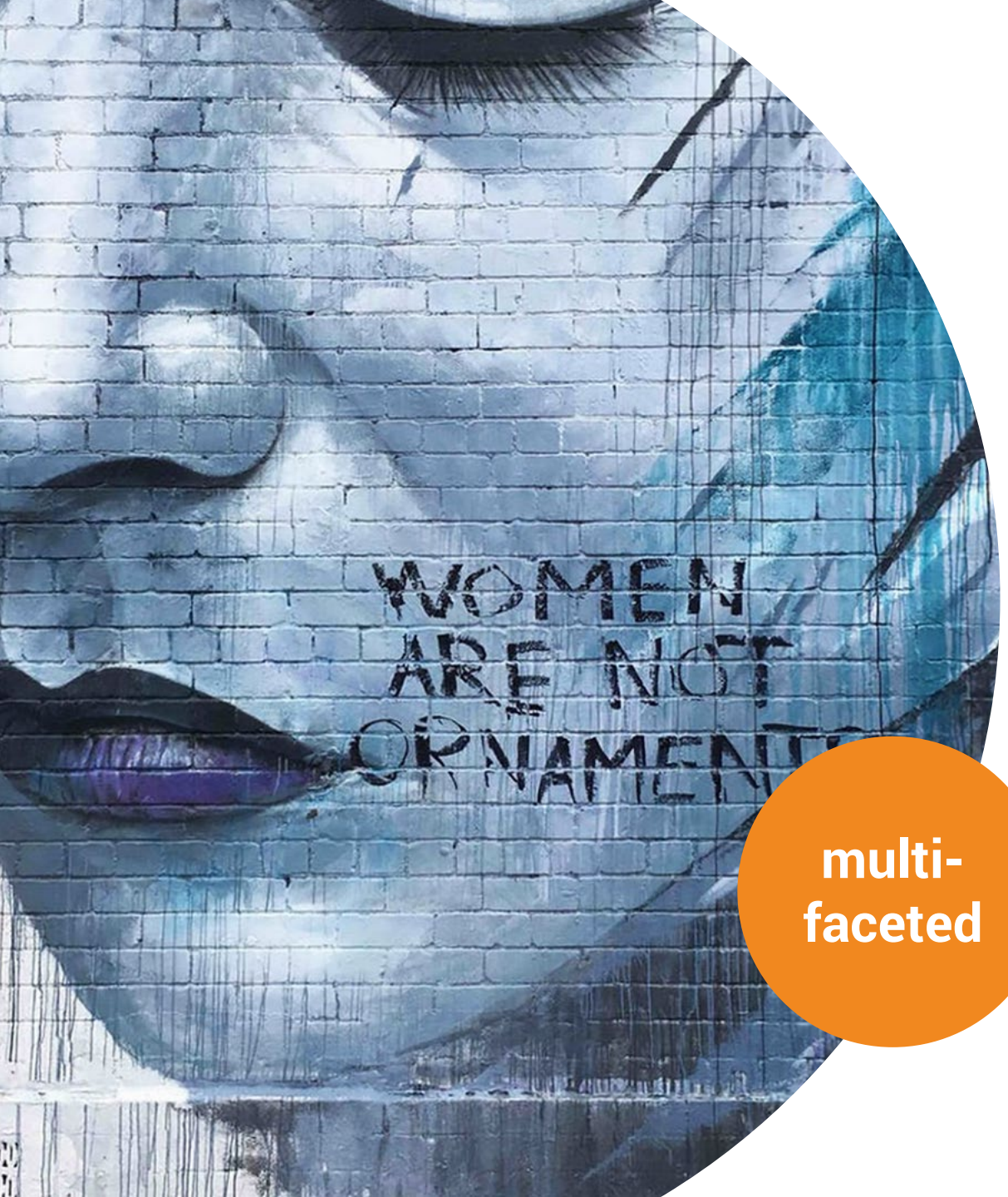

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graffiti are

unique

complex

short-lived

socially relevant

cultural heritage


KZJER

graffiti are

unique

complex

short-lived

socially relevant

cultural heritage

NEEDING
academic rigour

“For as long as we are imprecise about the artworks we are discussing, our research will be rightfully seen as lacking scholarly rigor.“

de la Iglesia 2015

RECORDING

random

partial

inaccurate

NEEDING
academic rigour

“For as long as we are imprecise about the artworks we are discussing, our research will be rightfully seen as lacking scholarly rigor.“

de la Iglesia 2015

RECORDING

random

partial

inaccurate

DISSEMINATION

unstandardised

limited interaction

closed access

NEEDING
academic rigour

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de la Iglesia 2015

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random

partial

inaccurate

DISSEMINATION

unstandardised

limited interaction

closed access

ANALYSIS

descriptive

fragmentary

biased

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de la Iglesia 2015

RECORDING

random

partial

inaccurate

DISSEMINATION

unstandardised

limited interaction

closed access

ANALYSIS

descriptive

fragmentary

biased

SYNERGY

one-sided

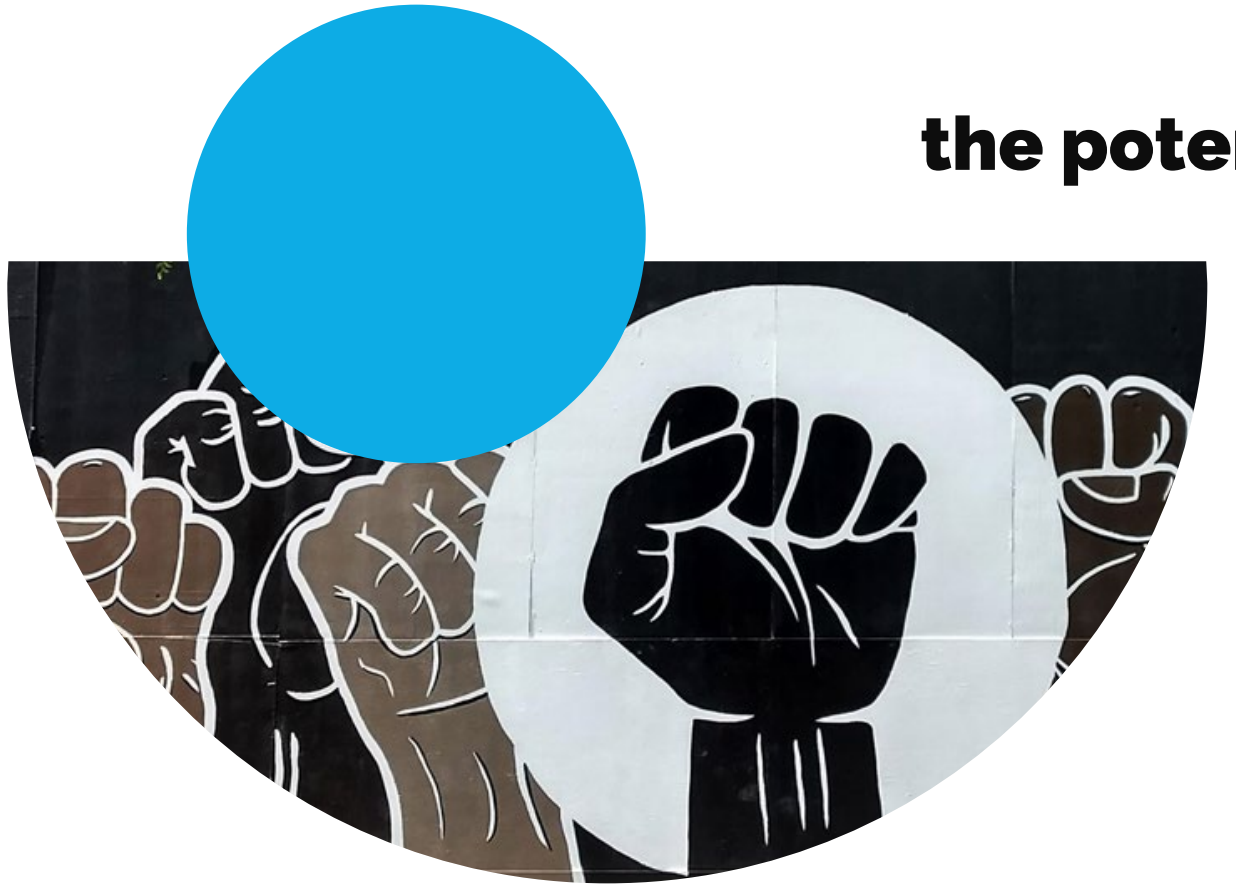
partial know-how

limited output

NEEDING academic rigour

“For as long as we are imprecise about the artworks we are discussing, our research will be rightfully seen as lacking scholarly rigor.“

de la Iglesia 2015



the potential
of graffiti
to understand
society
is under-exploited

indigo

Inventory and

disseminate

graffiti along the

d**o**naukanal

Inventory and

disseminate

graffiti along the

d**o**naukanal

WHAT

INventory and

disseminate

graffiti along the

d**O**naukanal

WHAT

WHERE

INventory and

DIsseminate

Graffiti along the

d**O**naukanal

WHAT

WHERE

WHY

digitally preserve

and

analyse

INventory and

DIsseminate

Graffiti along the

DOnaukanal

WHAT

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digitally preserve

and

analyse

WHERE

ÖAW

TU WIEN GEO

GiFLE

vrvis

Stadt Wien

SPRAY CITY.AT

LUDWIG BOLTZMANN INSTITUTE
Archaeological Prospection and Virtual Archaeology

WHO

INventory and

DIsseminate

Graffiti along the

d**O**naukanal

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Archaeological Prospection and Virtual Archaeology

Heritage Science Austria programme | **€ 580 k** | **2** years

WHY

Inventory and

disseminate

graffiti along the

donaukanal

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and

analyse

? HOW ?

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vr vis

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Archaeological Prospection and Virtual Archaeology

WHO

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INDIGO approach

5 research pillars

INDIGO approach

5 research pillars

creation

INDIGO approach

5 research pillars

creation

acquisition

INDIGO approach

5 research pillars

creation

acquisition

processing

INDIGO approach

5 research pillars

creation

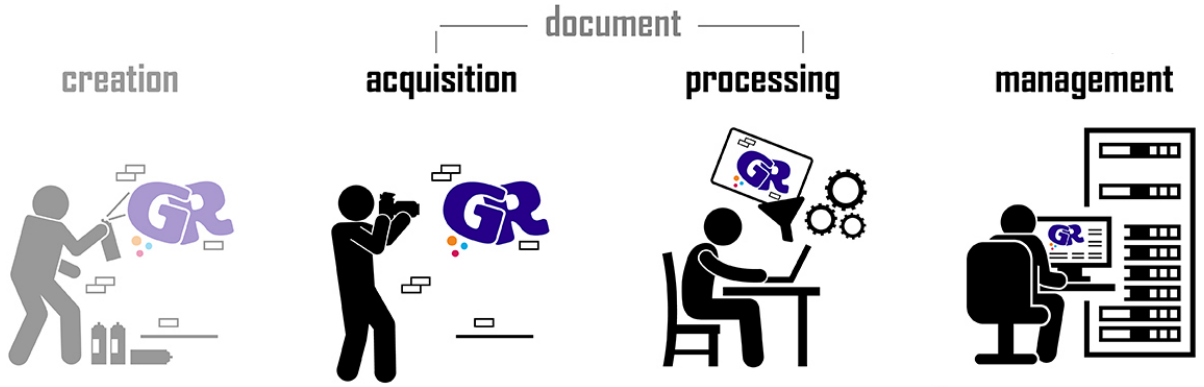
acquisition

processing

management

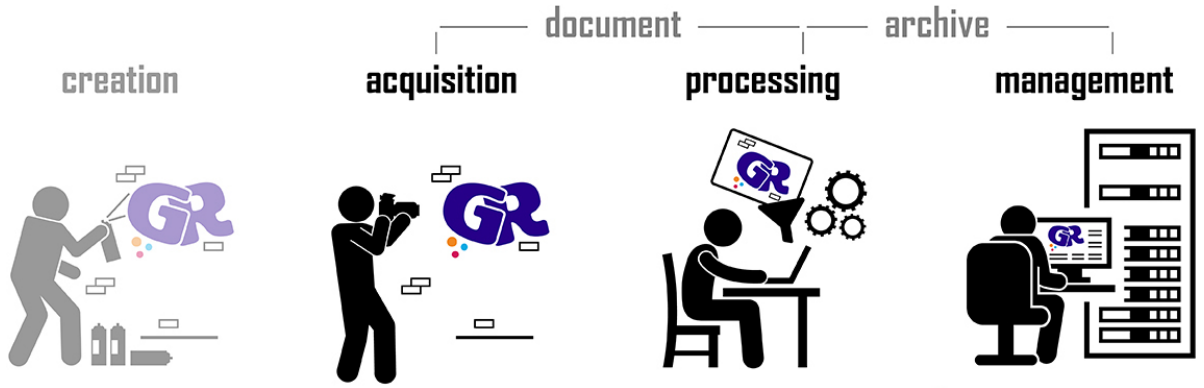
INDIGO approach

5 research pillars



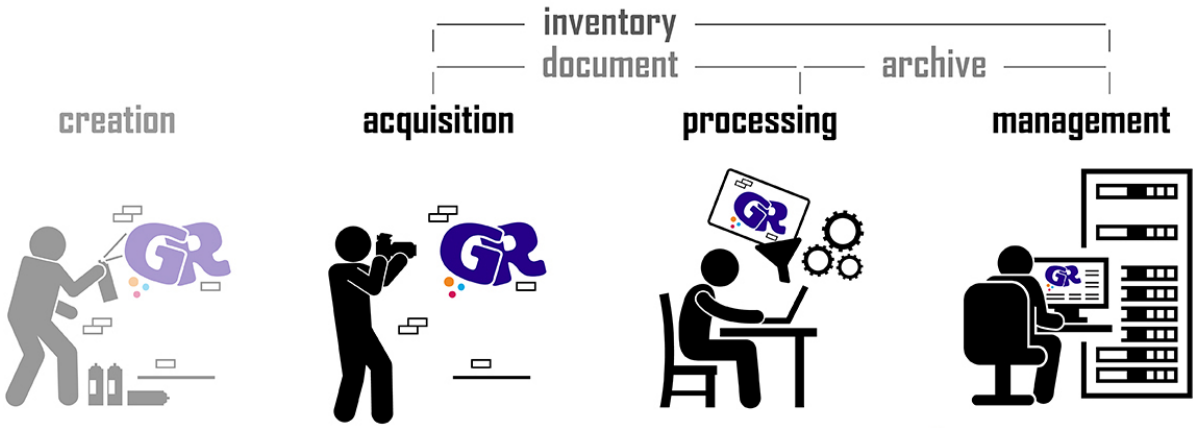
INDIGO approach

5 research pillars



INDIGO approach

5 research pillars



INDIGO approach

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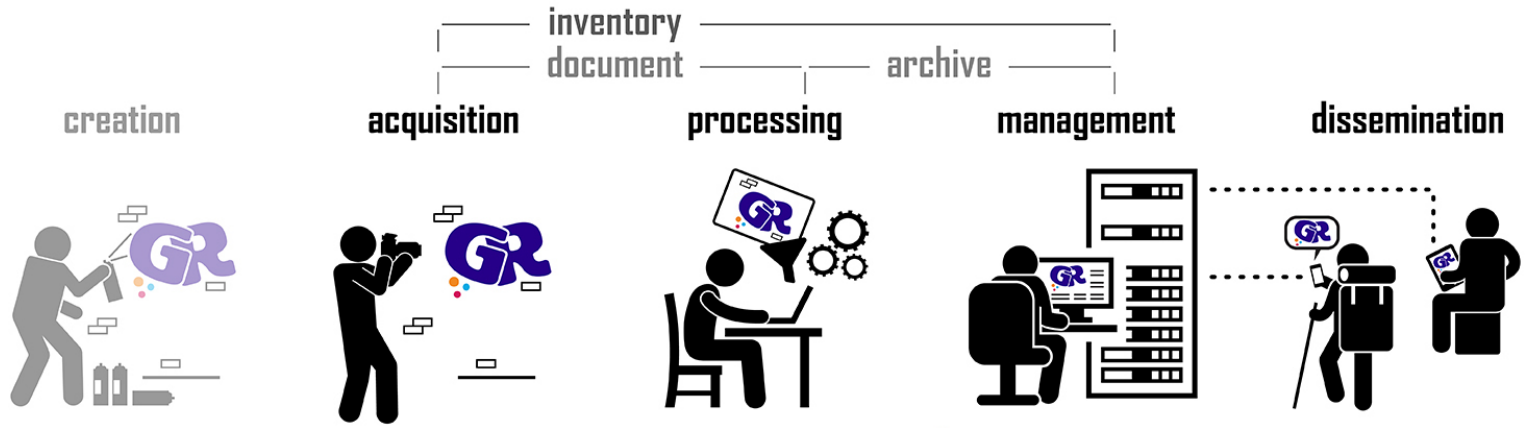
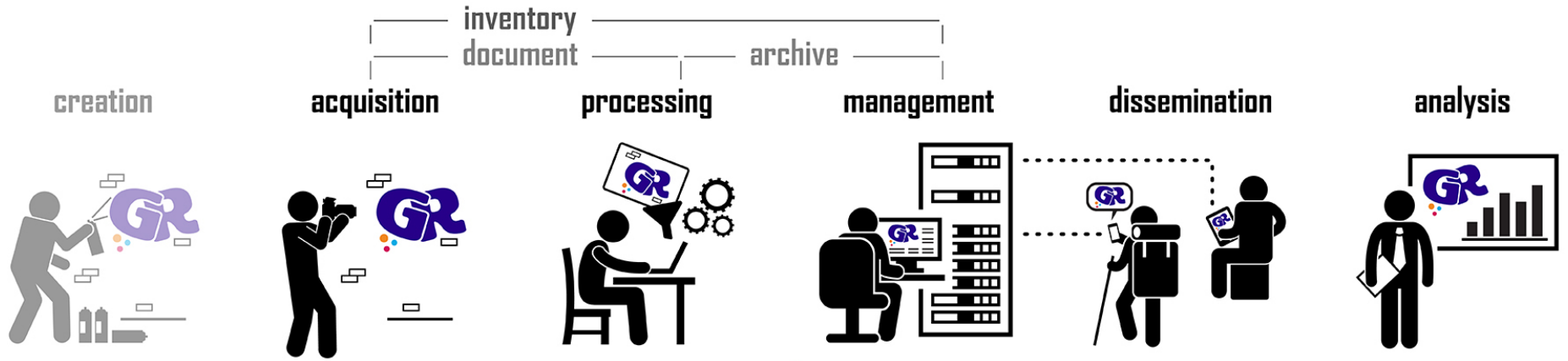


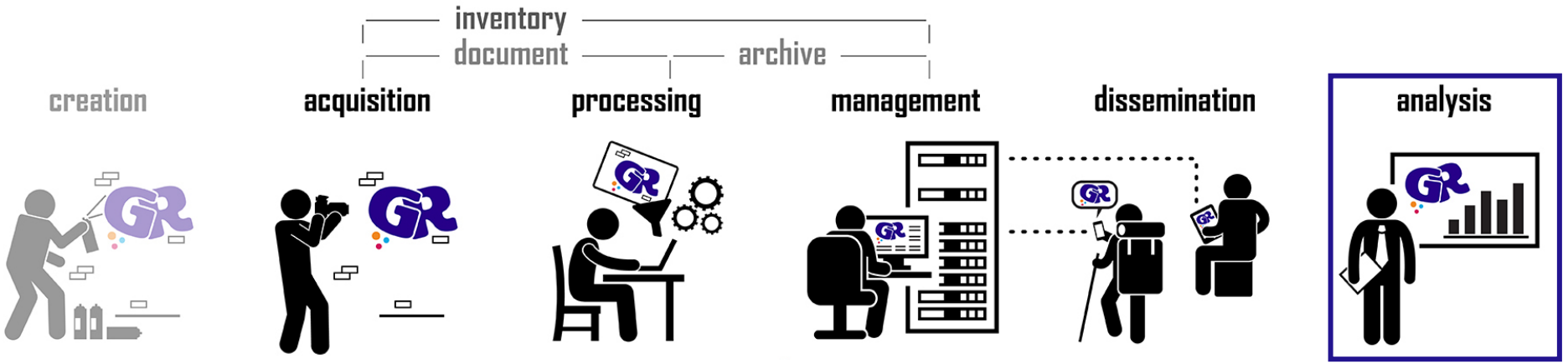
INDIGO approach

5 research pillars



POTENTIAL questions

5 research pillars



POTENTIAL questions

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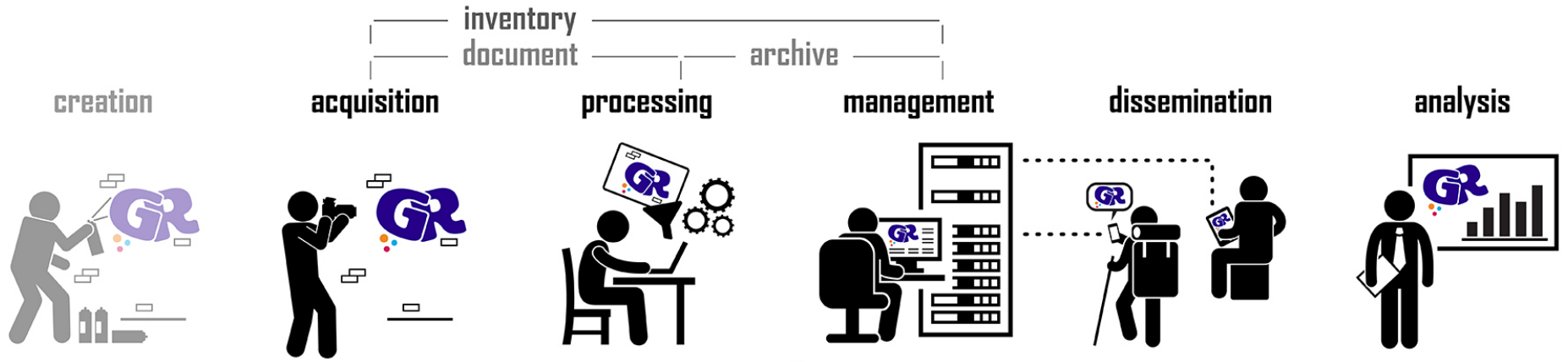
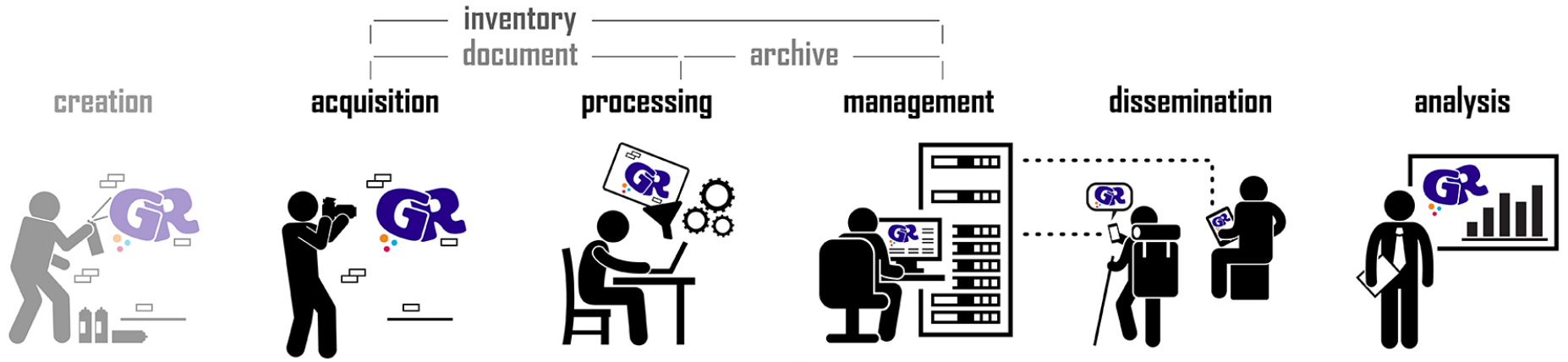


When and where do political graffiti typically appear ?

POTENTIAL questions

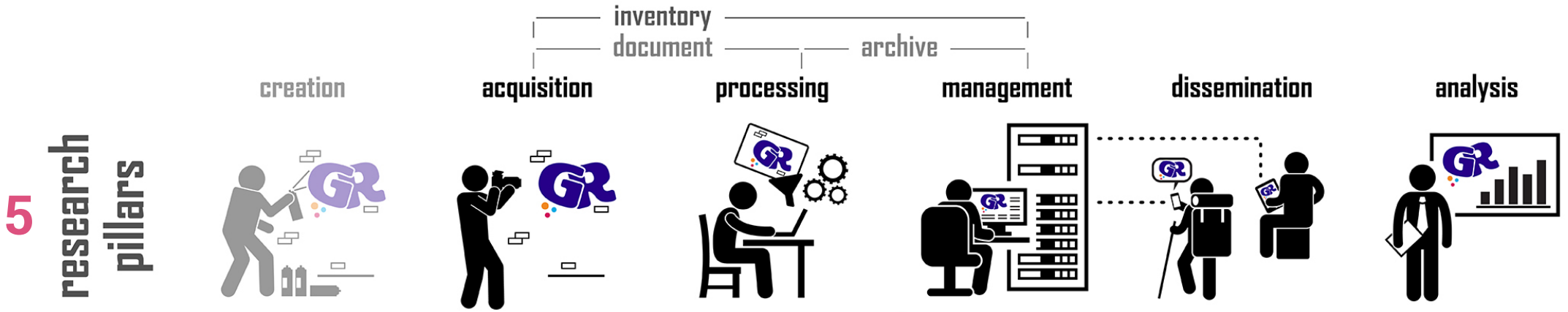
5 research pillars



When and where do political graffiti typically appear ?

What are the main styles and colours of those graffiti, and how long do they – on average – stay visible before they are (partly or entirely) covered ?

POTENTIAL questions



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POTENTIAL questions

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GRAFFITI *TEMPORALITY*

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GRAFFITI *LOCATION*

GRAFFITI *TEMPORALITY*

GRAFFITI *TERMINOLOGY*

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POTENTIAL questions

GRAFFITI *LOCATION*
GRAFFITI *TEMPORALITY*
GRAFFITI *TERMINOLOGY*
GRAFFITI *CHARACTERISATION*

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GRAFFITI archaeology

GRAFFITI *LOCATION*
GRAFFITI *TEMPORALITY*
GRAFFITI *TERMINOLOGY*
GRAFFITI *CHARACTERISATION*

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GRAFFITI archaeology

ARTEFACT

LOCATION
TEMPORALITY
TERMINOLOGY
CHARACTERISATION

When and where do political graffiti typically appear ?

What are the main styles and colours of those graffiti, and how long do they – on average – stay visible before they are (partly or entirely) covered ?

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SOME results

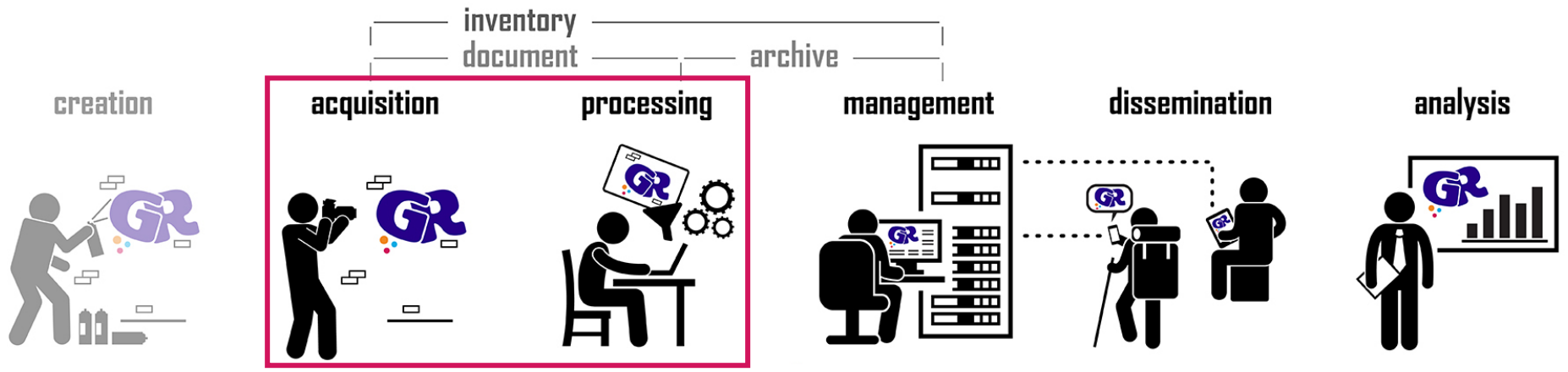
GRAFFITI *LOCATION*

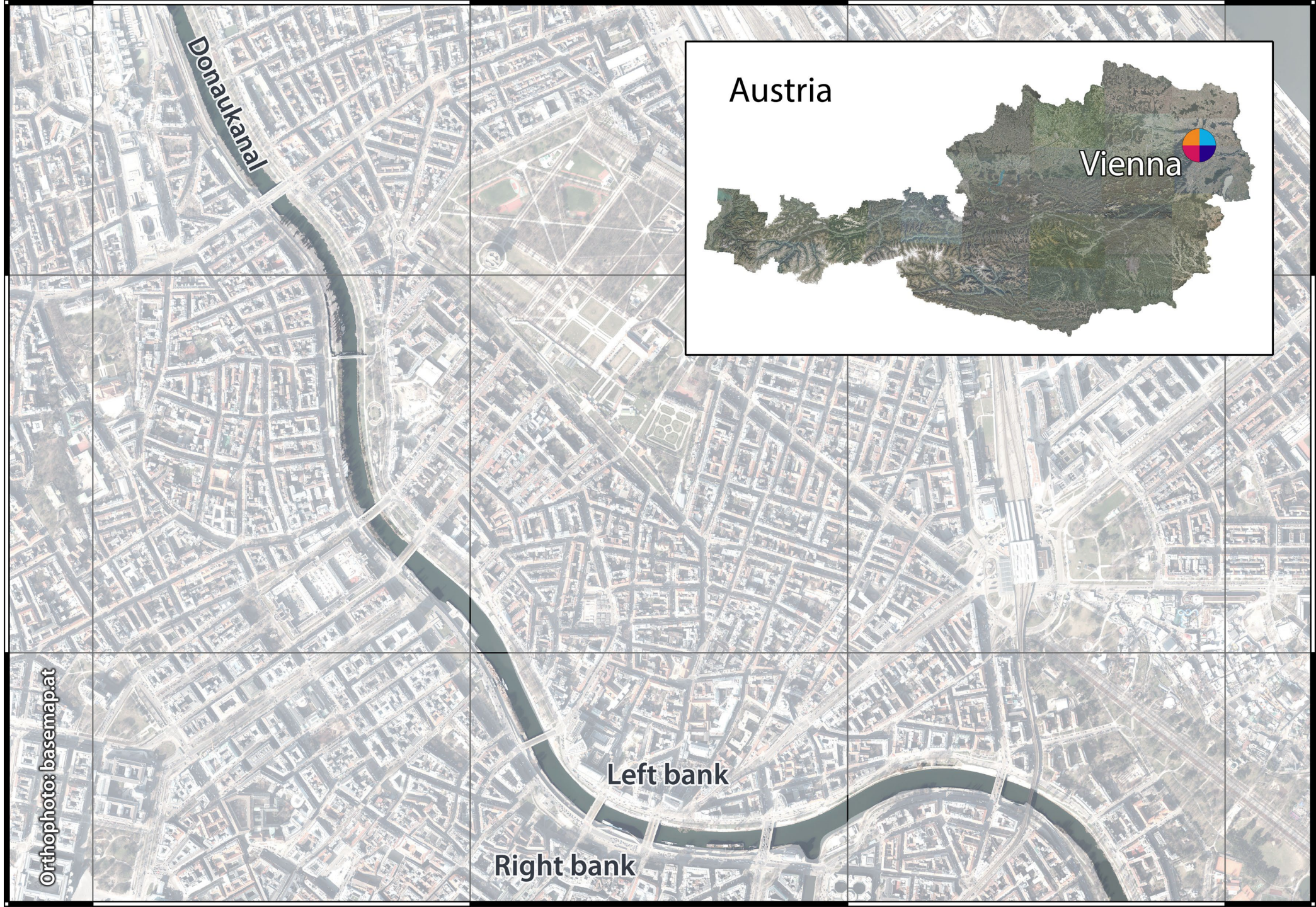
GRAFFITI *TEMPORALITY*

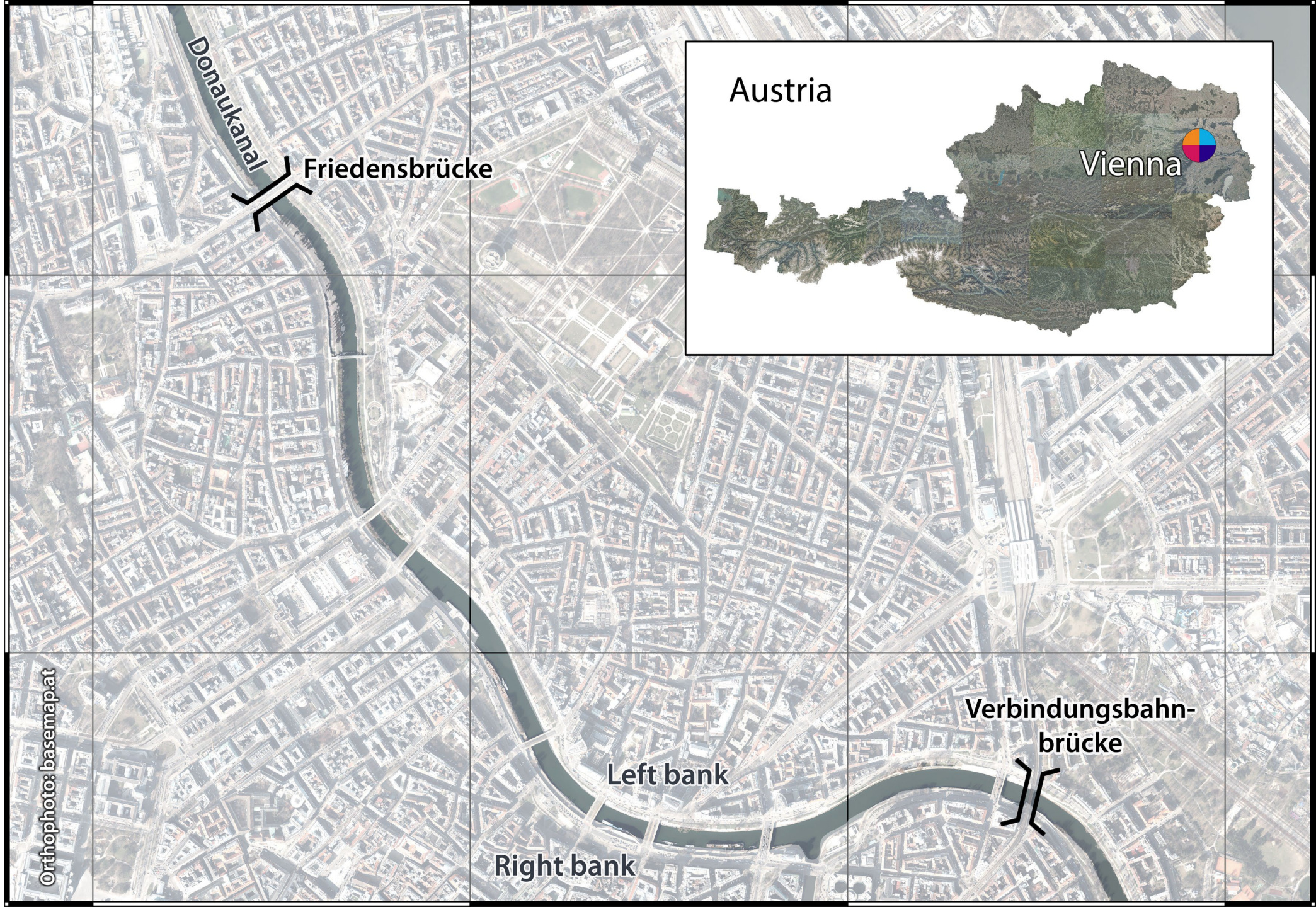
GRAFFITI *TERMINOLOGY*

GRAFFITI *CHARACTERISATION*

5 research pillars

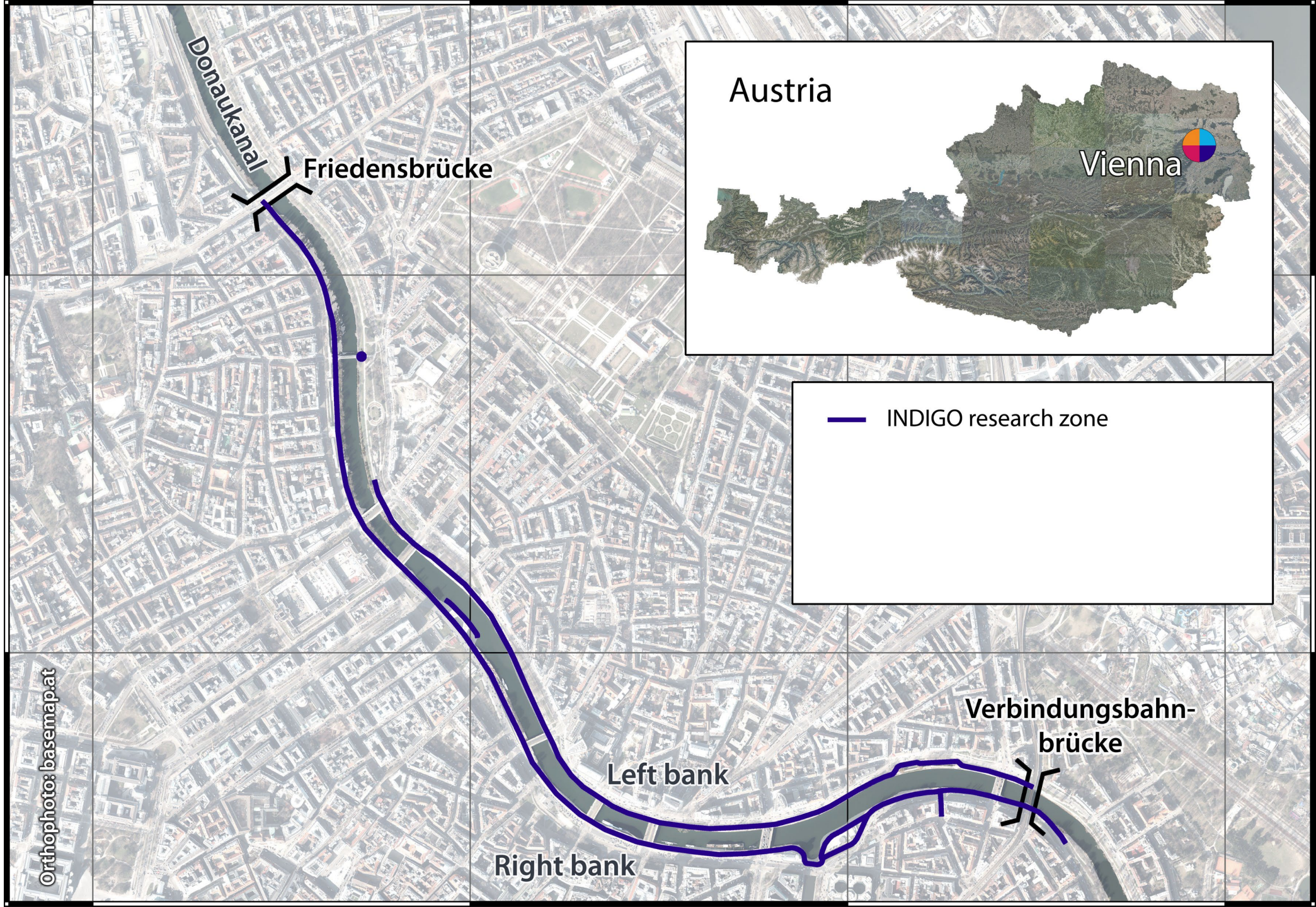



Donaukanal
Austria
Vienna
Left bank
Right bank
Orthophoto: basemap.at


Donaukanal
Friedensbrücke
Austria
Vienna
Orthophoto: basemap.at
Left bank
Right bank
Verbindungsbahn-
brücke

STRETCH

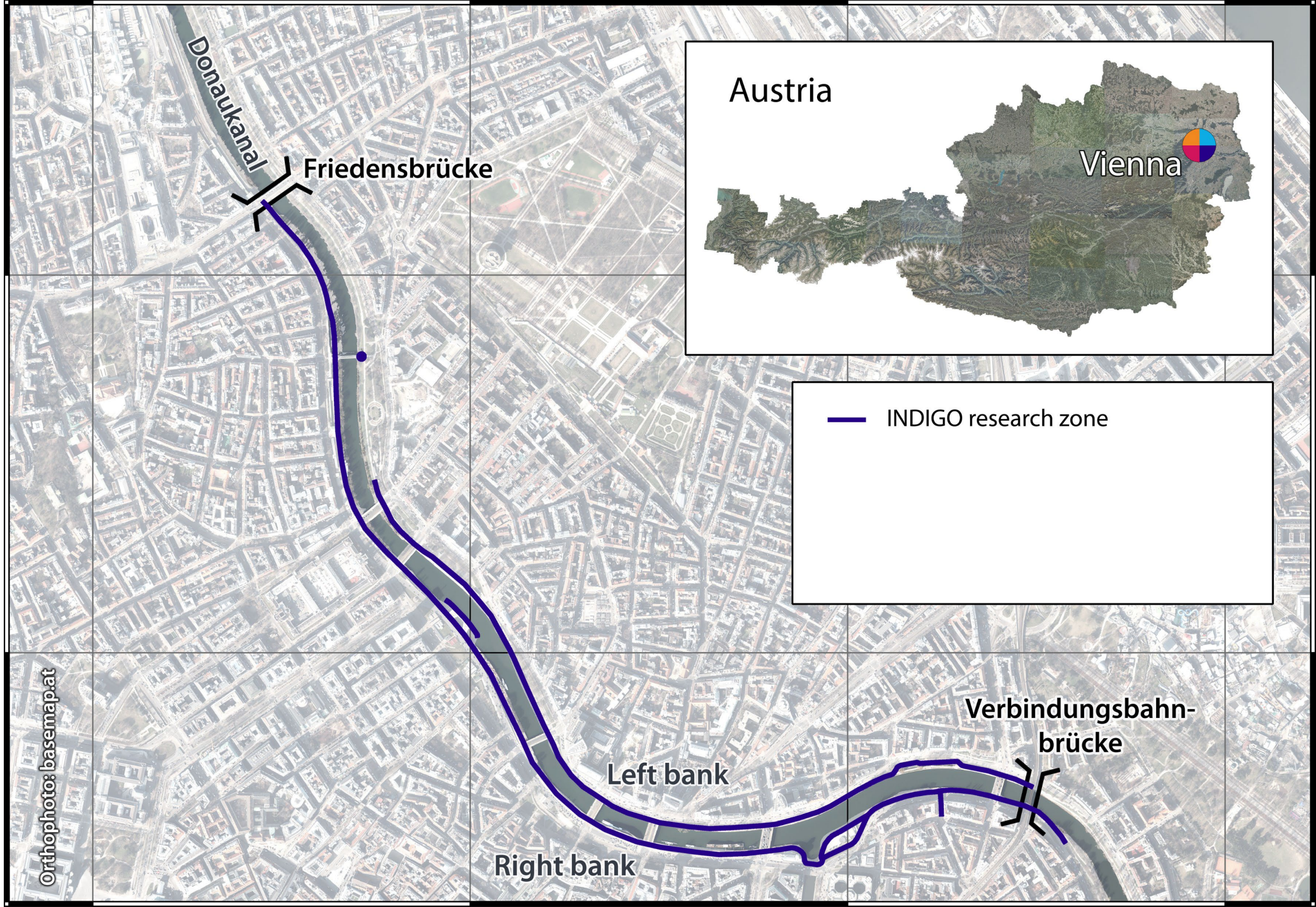
3.3 km



STRETCH

3.3 km

LEFT **RIGHT**



STRETCH

3.3 km

LEFT **RIGHT**

STRETCH

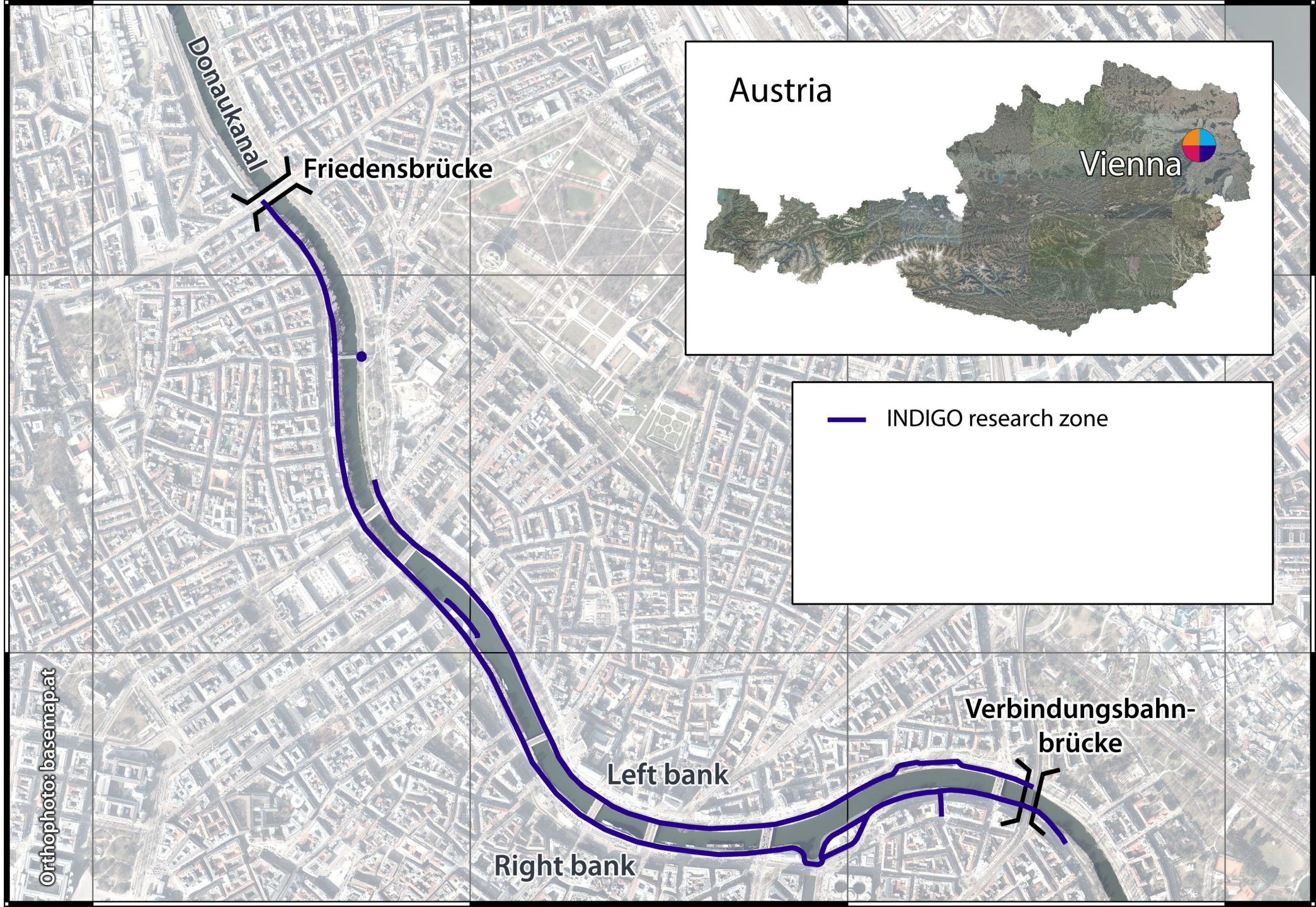
3.3 km

LEFT	RIGHT
UP	UP
DOWN	DOWN

STRETCH

3.3 km

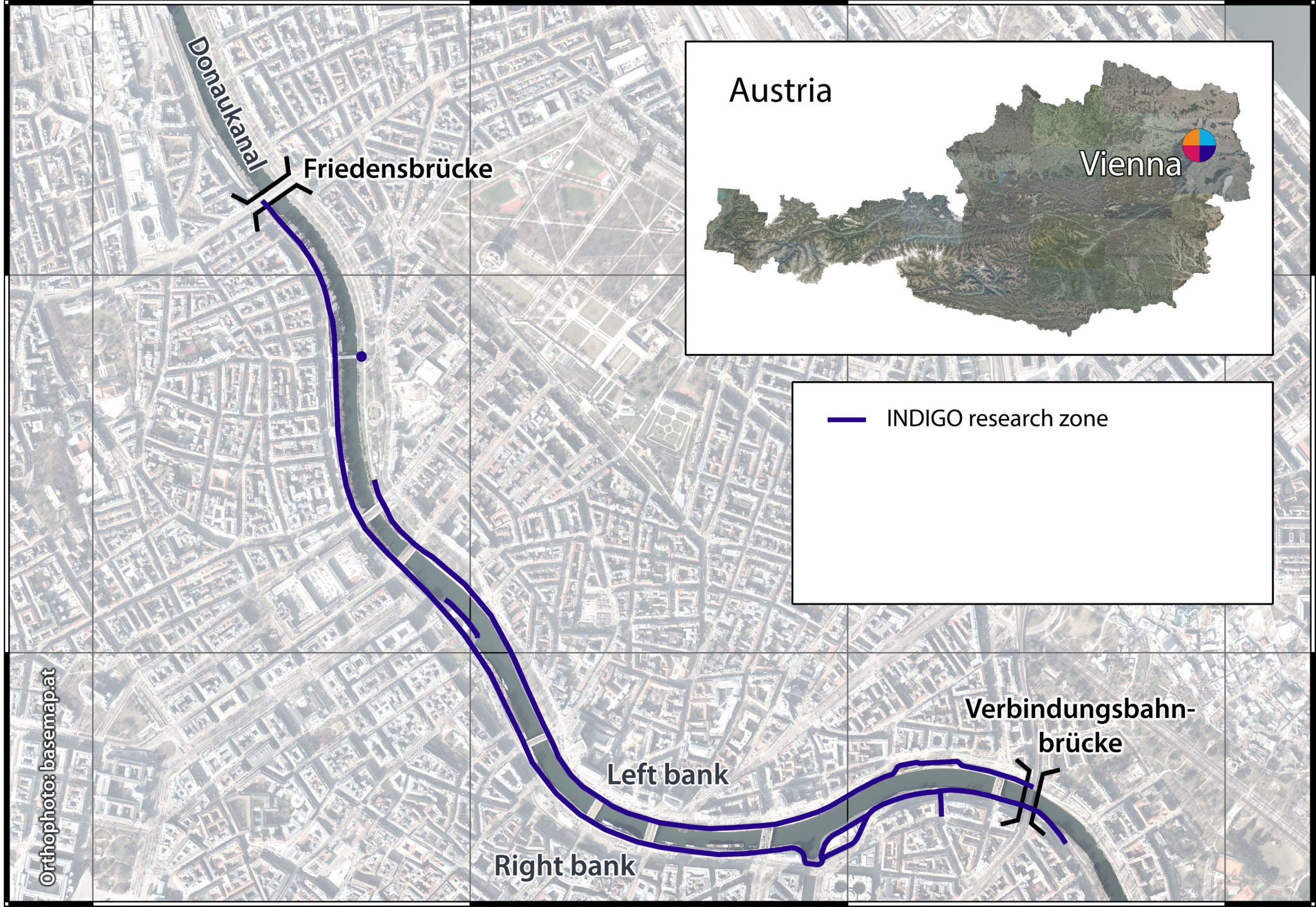
LEFT	RIGHT
UP	UP
3.2 km	5.3 km
DOWN	DOWN



STRETCH

3.3 km

LEFT	RIGHT
UP	UP
3.2 km	5.3 km
DOWN	DOWN
2.1 km	2.3 km



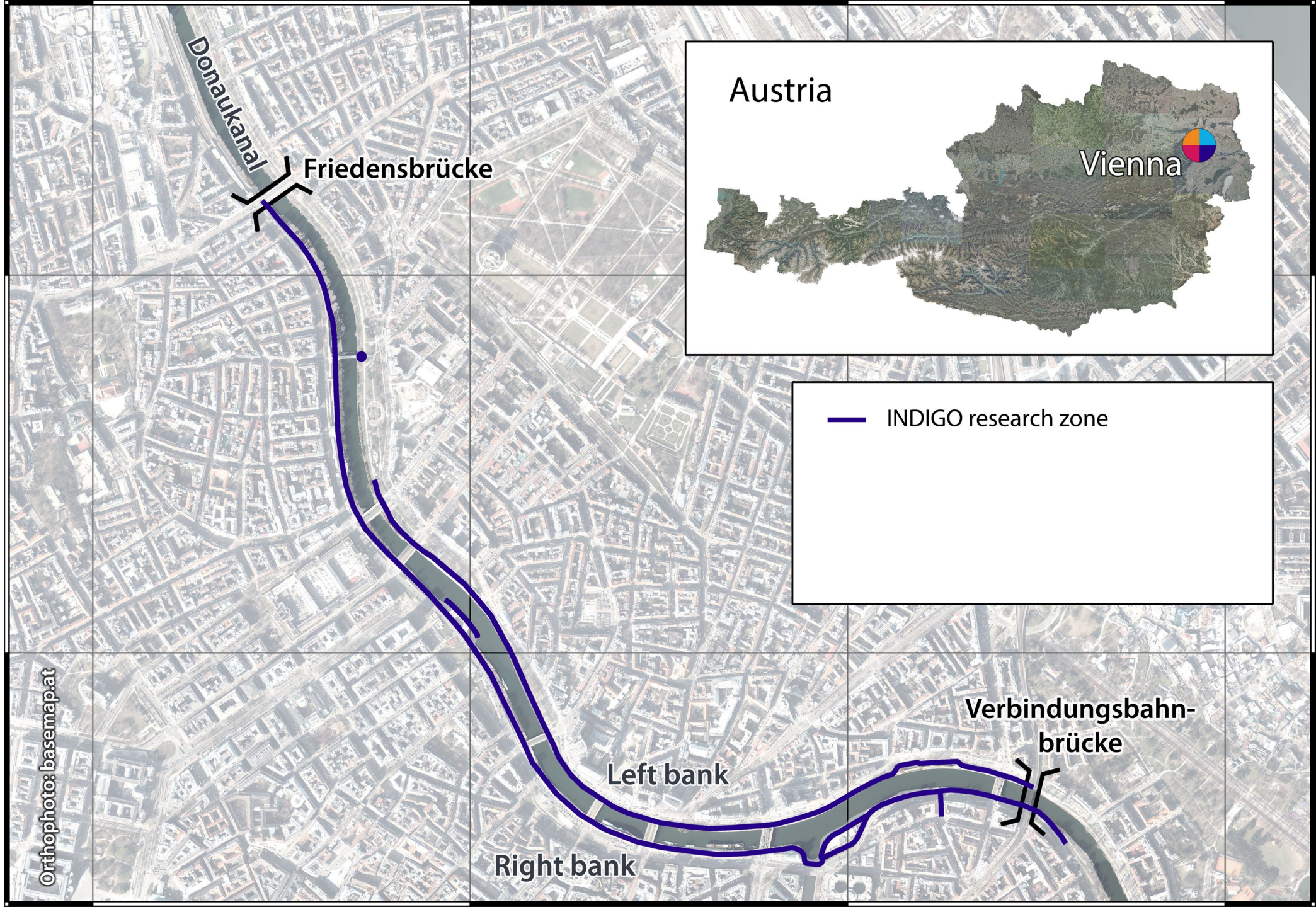
STRETCH

3.3 km

LEFT	RIGHT
UP	UP
3.2 km	5.3 km
DOWN	DOWN
2.1 km	2.3 km

MONITORED SURFACES

12.9 km



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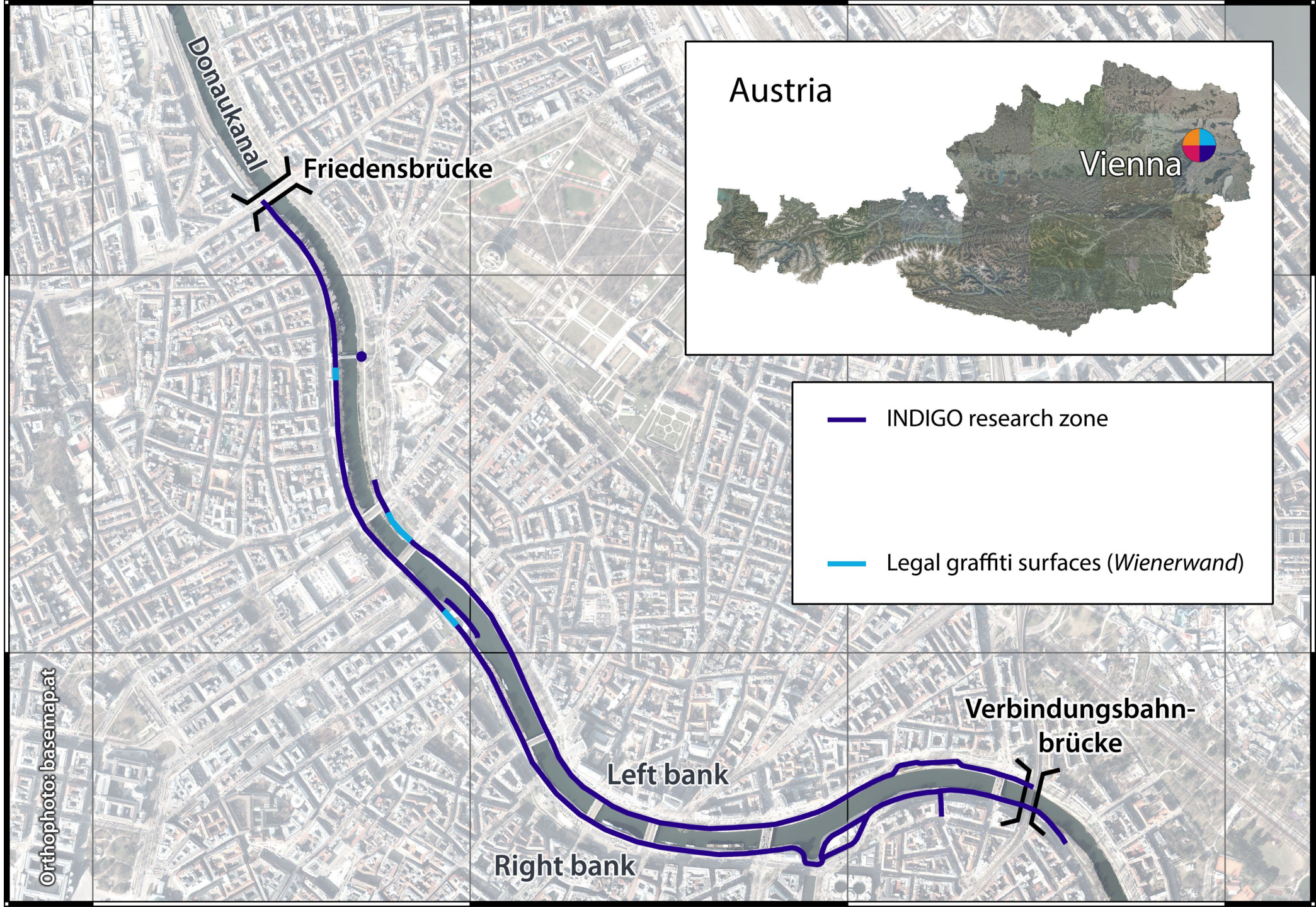
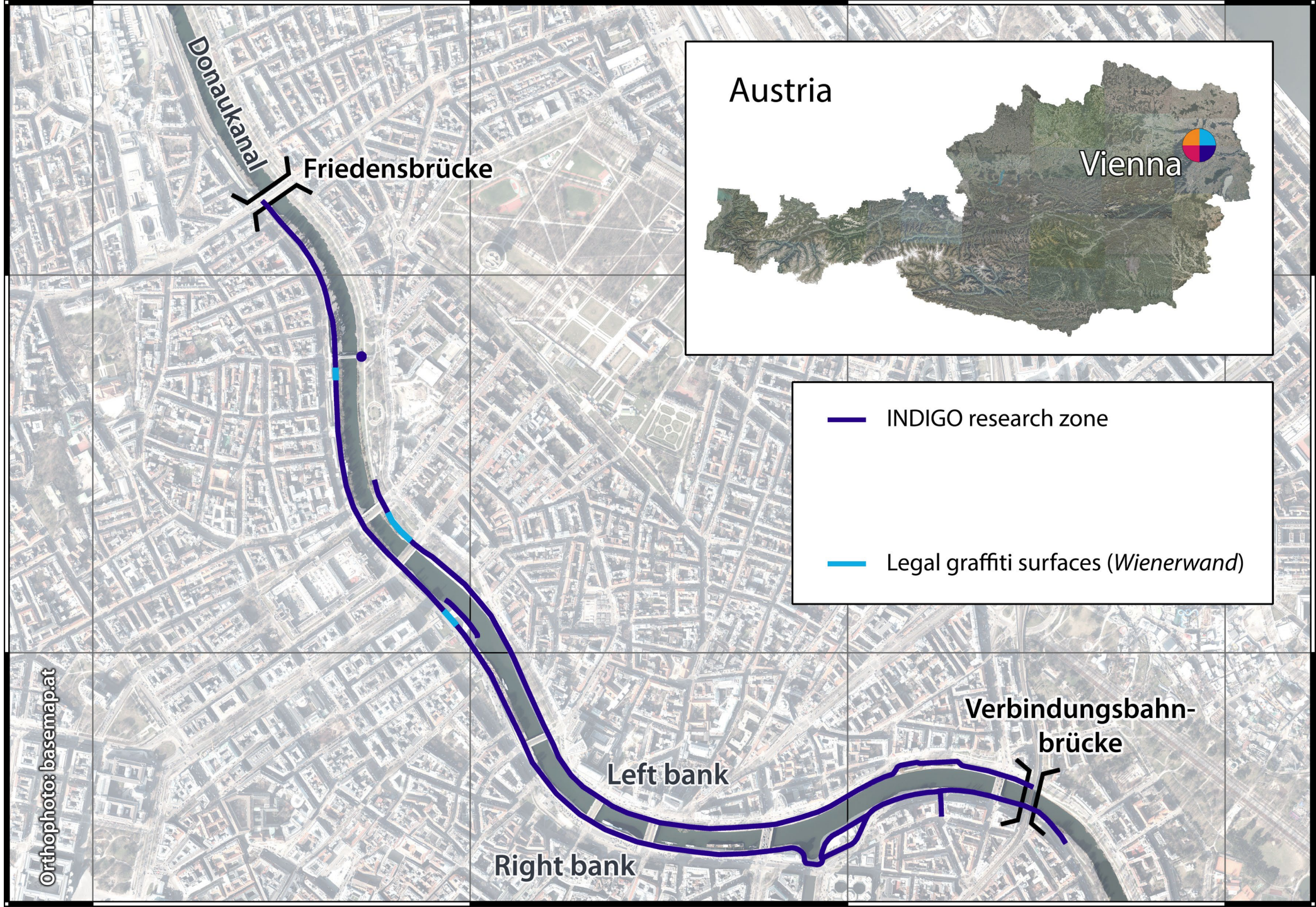


LEGAL SURFACES

0.3 km

MONITORED SURFACES

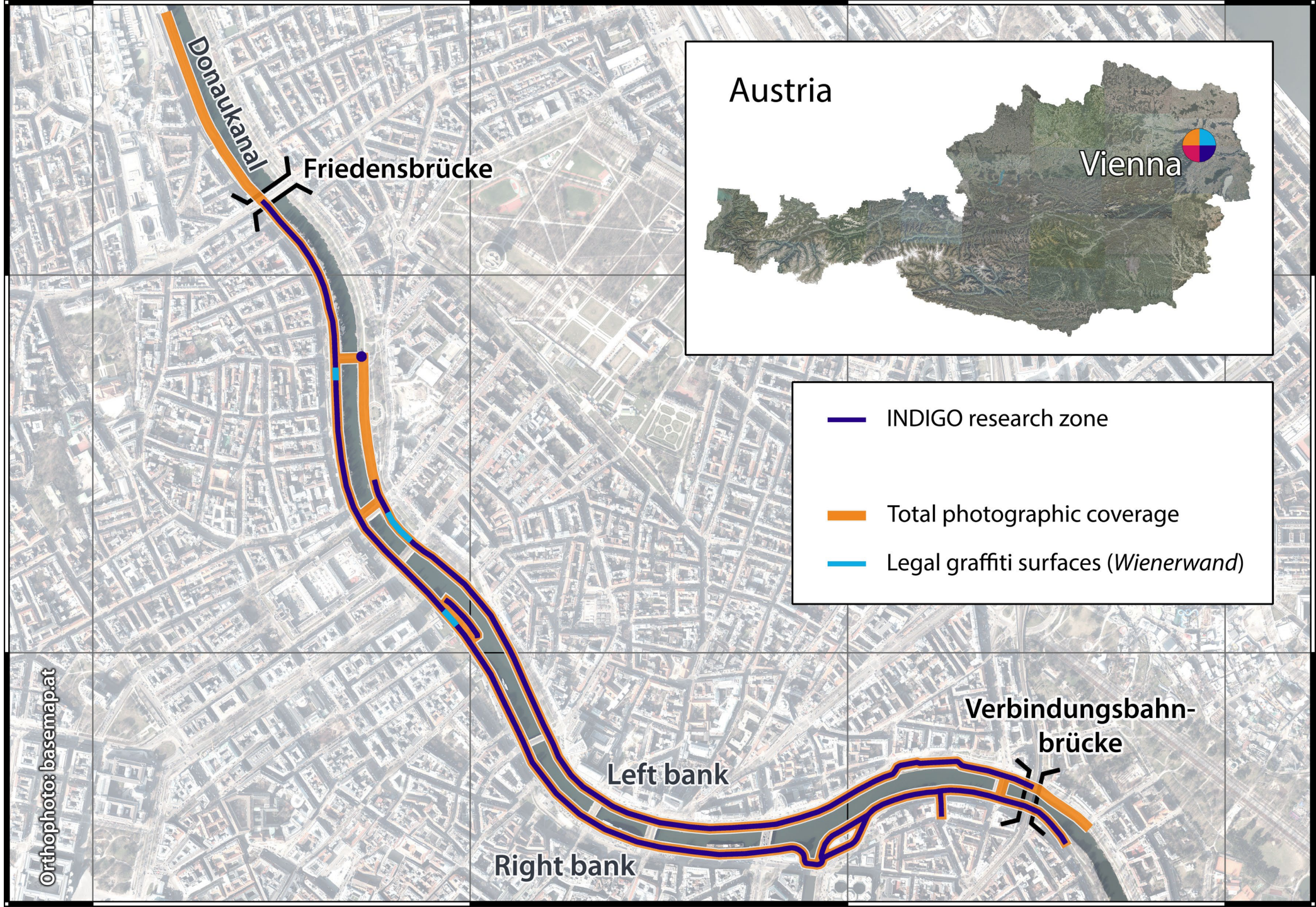
12.9 km



TOTAL COVERAGE
14.0 km

LEGAL SURFACES
0.3 km

MONITORED SURFACES
12.9 km



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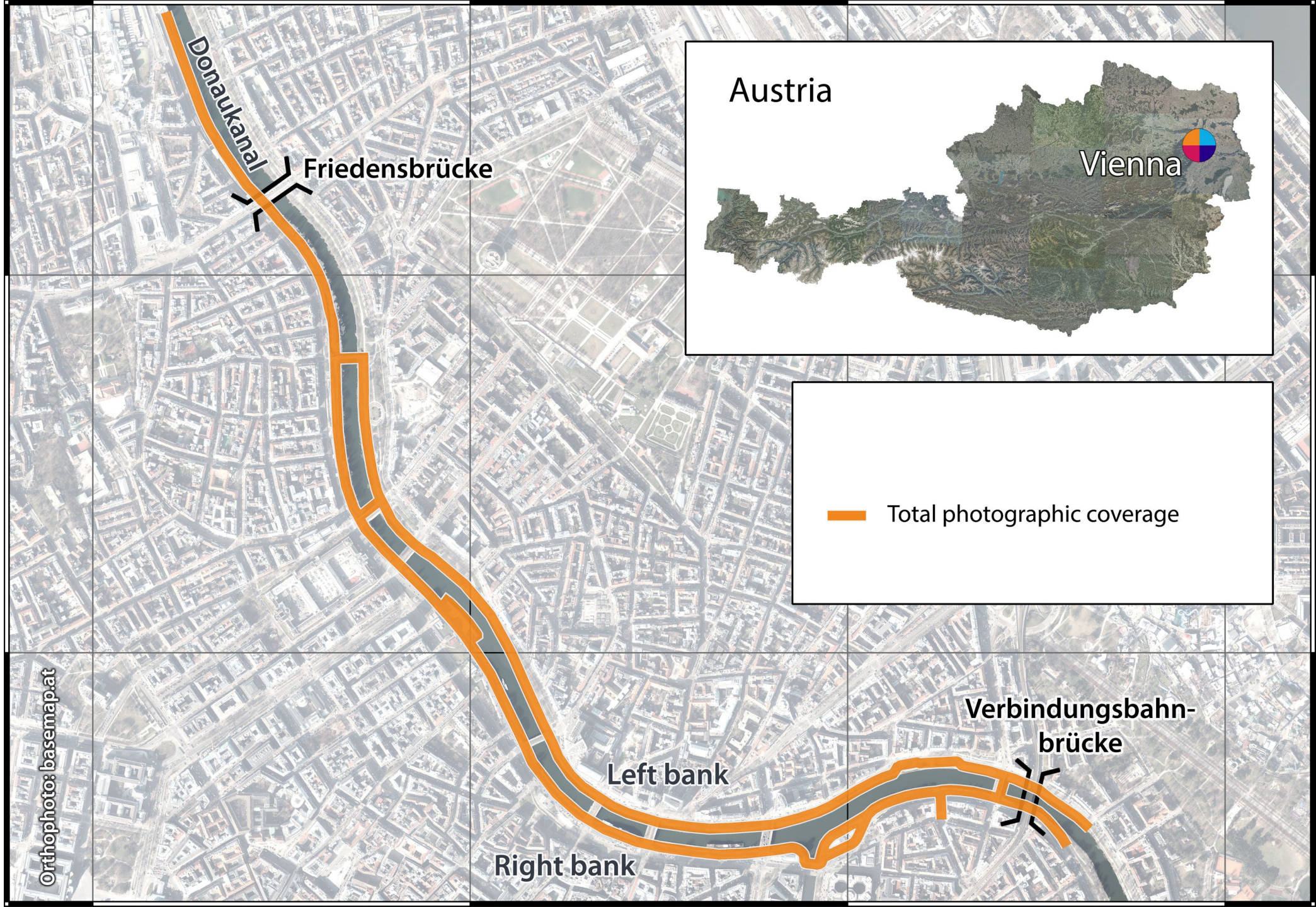
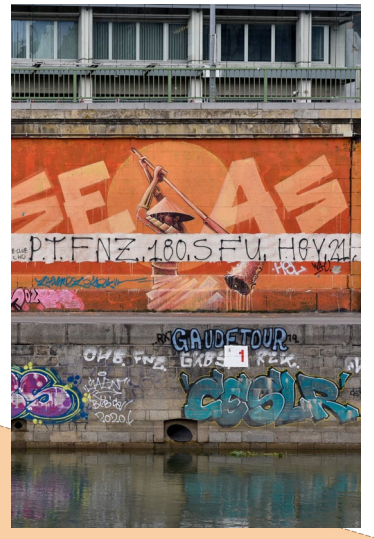
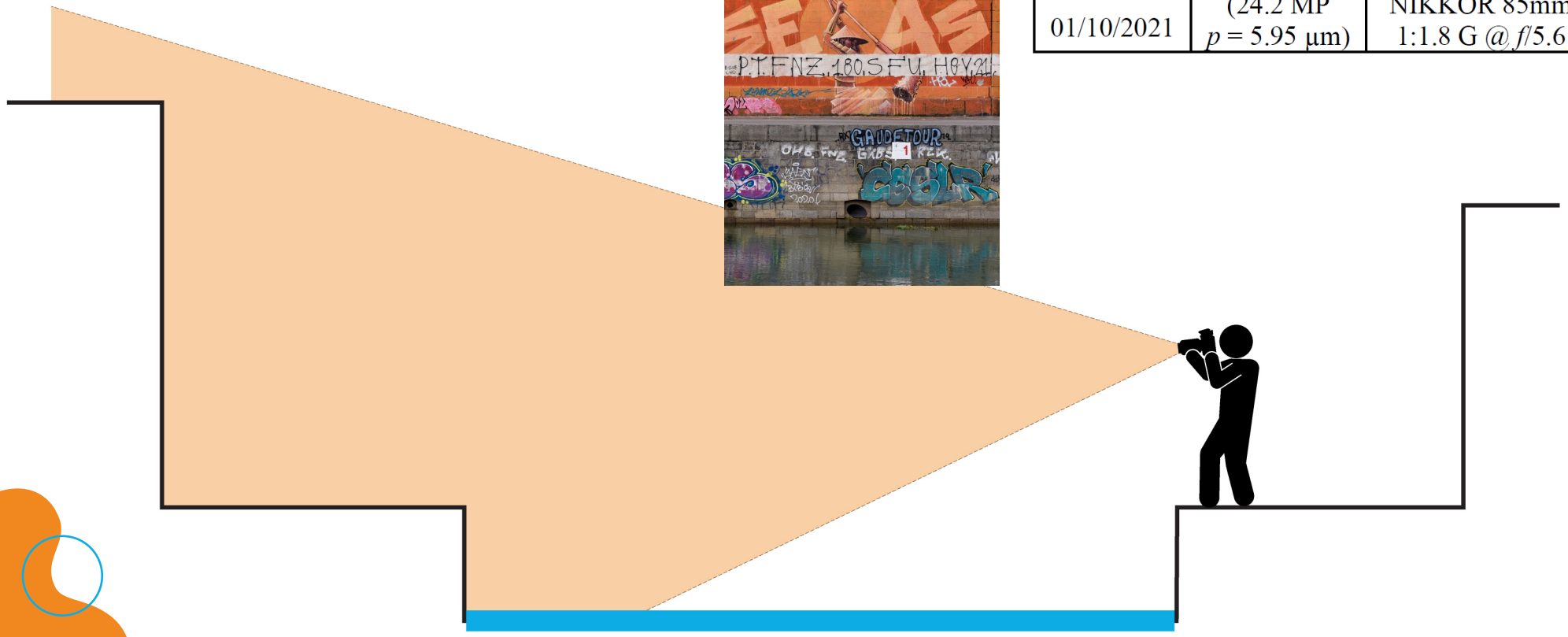
12.9 km



TOTAL coverage



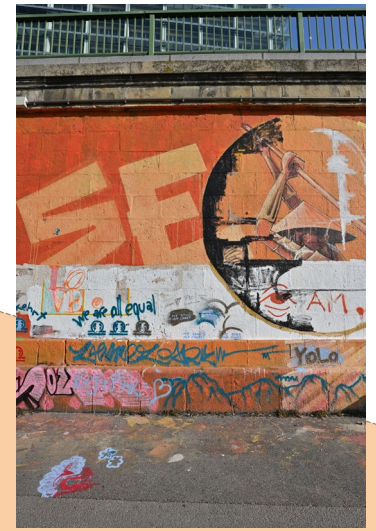
Date	Camera	Lens	Mean GSD	Acquisition time	Image count
30/09/2021 01/10/2021	Nikon D750 (24.2 MP p = 5.95 µm)	Nikon AF-S NIKKOR 85mm 1:1.8 G @ f/5.6	3.6 mm	3 h 45 min 3 h 20 min	2065 2544

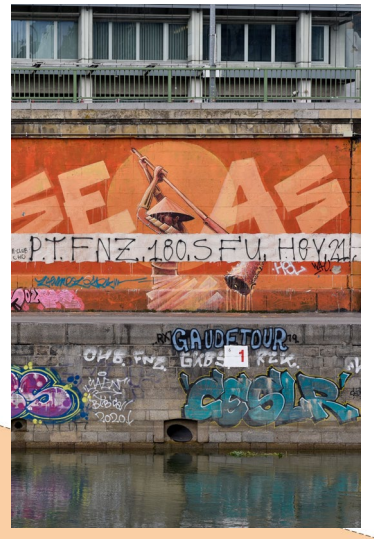


TOTAL coverage

Date	Camera	Lens	Mean GSD	Acquisition time	Image count
26/10/2021	Nikon Z 7II (45.4 MP $p = 4.33$ µm)	Nikon NIKKOR Z 20mm f/1.8 S @ *f*/5.6	0.9 mm	7 h	6042
27/10/2021				7 h 45 min	6591
28/10/2021				3 h 40 min	2856
29/10/2021				7 h	6608

TOTAL coverage





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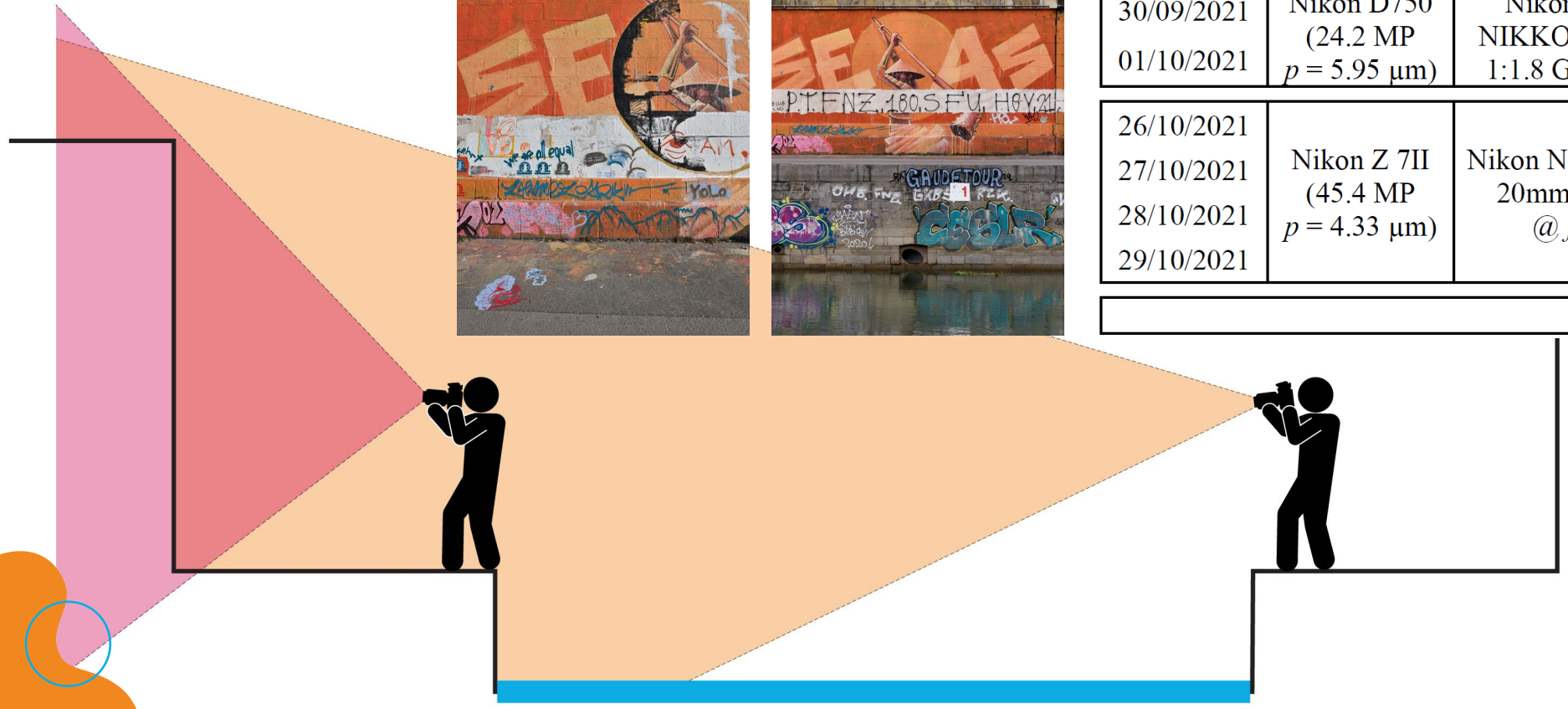
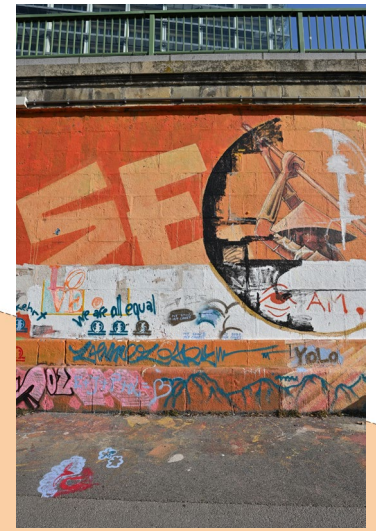
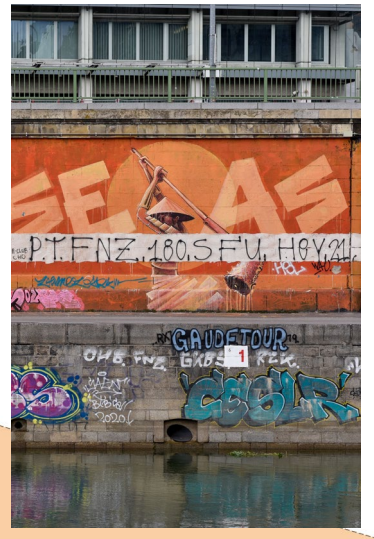
			Total	**32 h 30 min**	**26706**



TOTAL coverage





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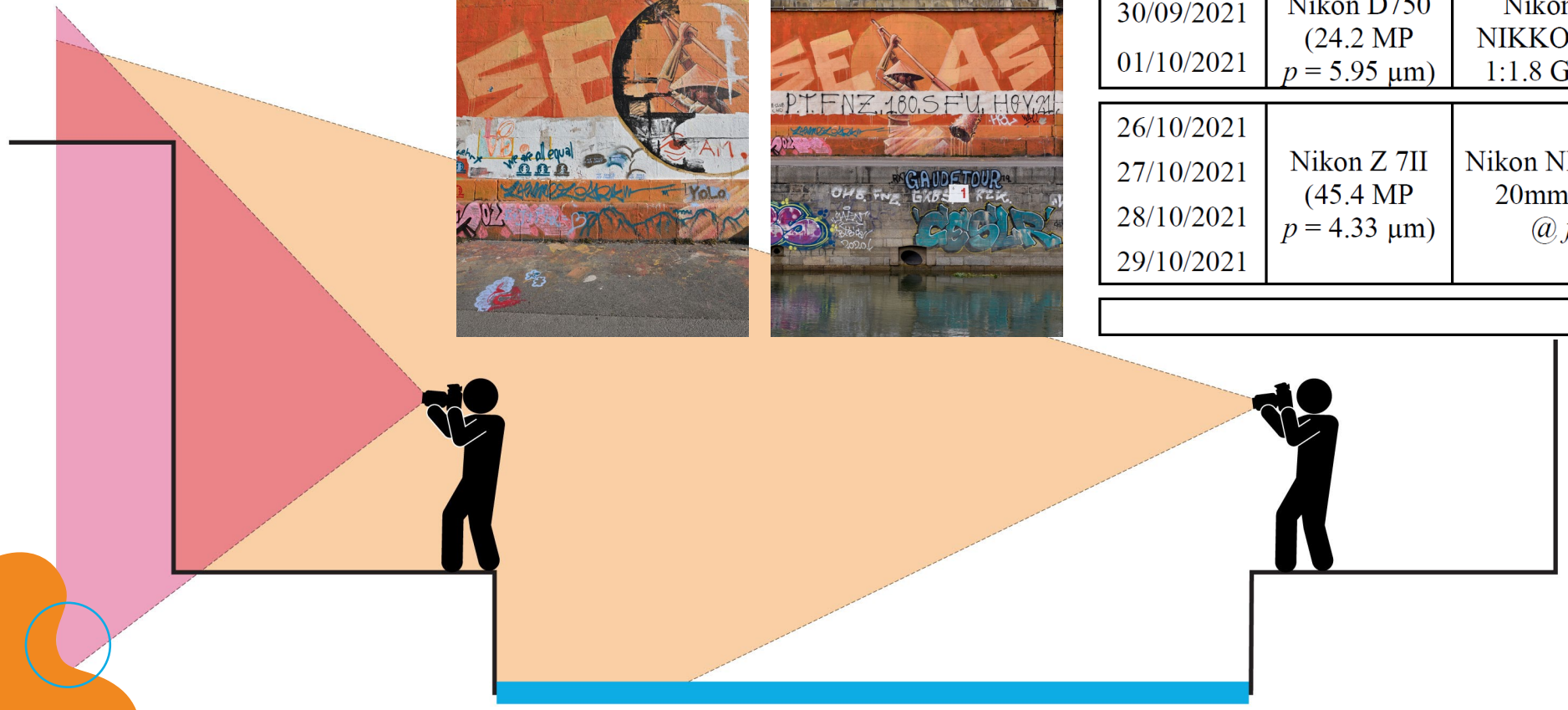
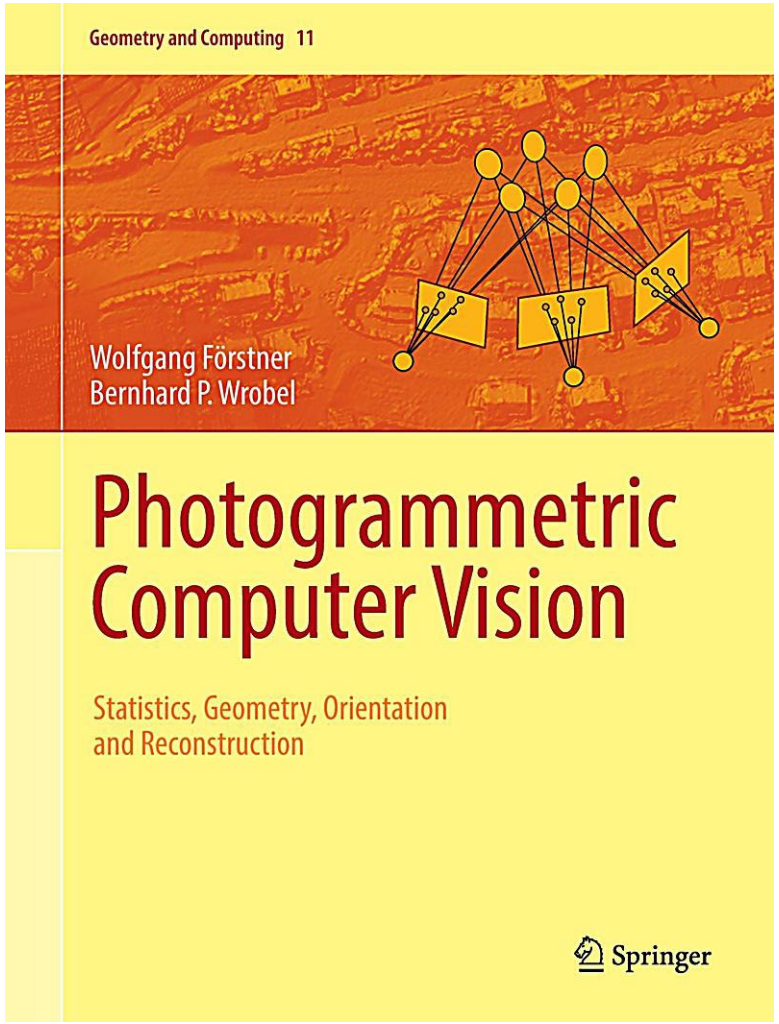
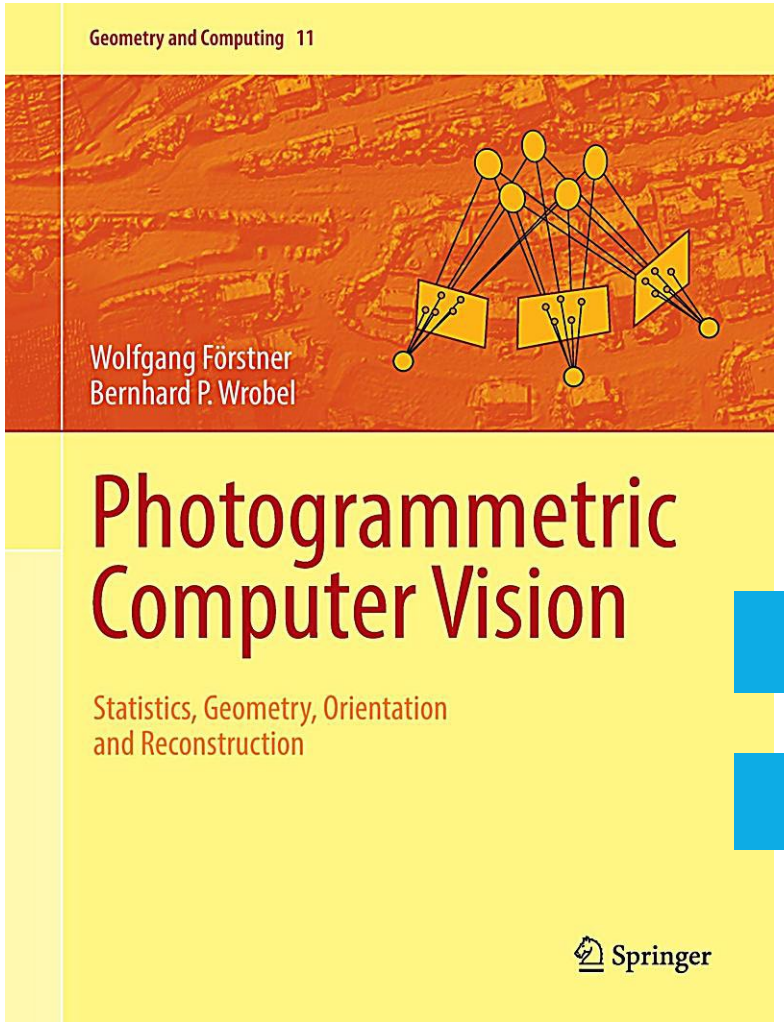


processing

PHOTOGRAMMETRIC computer vision



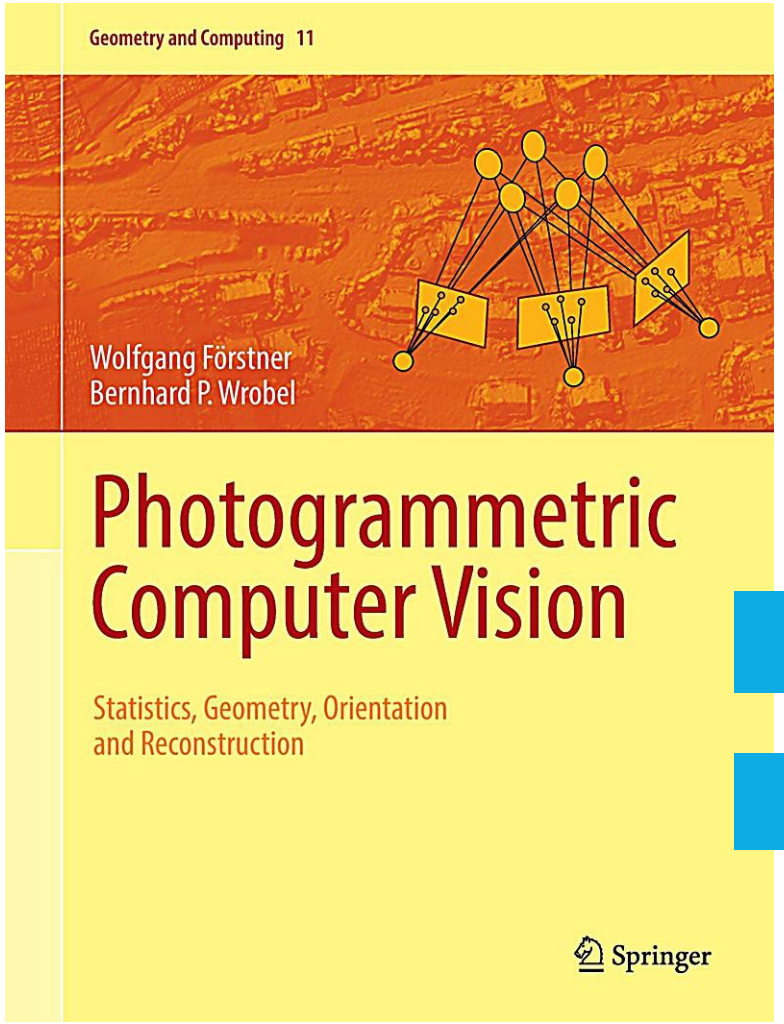
PHOTOGRAMMETRIC computer vision



Structure from Motion

Multi-View Stereo

PHOTOGRAMMETRIC computer vision

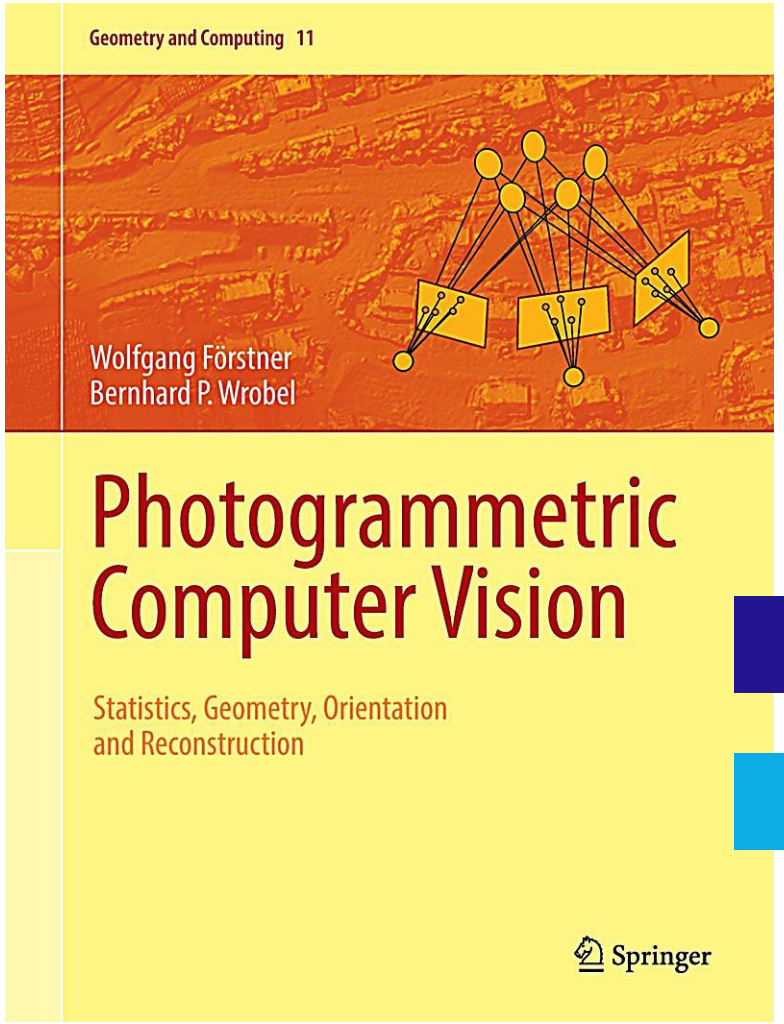


Metashape

Structure from Motion

Multi-View Stereo

PHOTOGRAMMETRIC computer vision



Metashape

Structure from Motion

Multi-View Stereo

STRUCTURE from motion

STRUCTURE from motion

DETECT *FEATURES*

STRUCTURE from motion

DETECT *FEATURES*

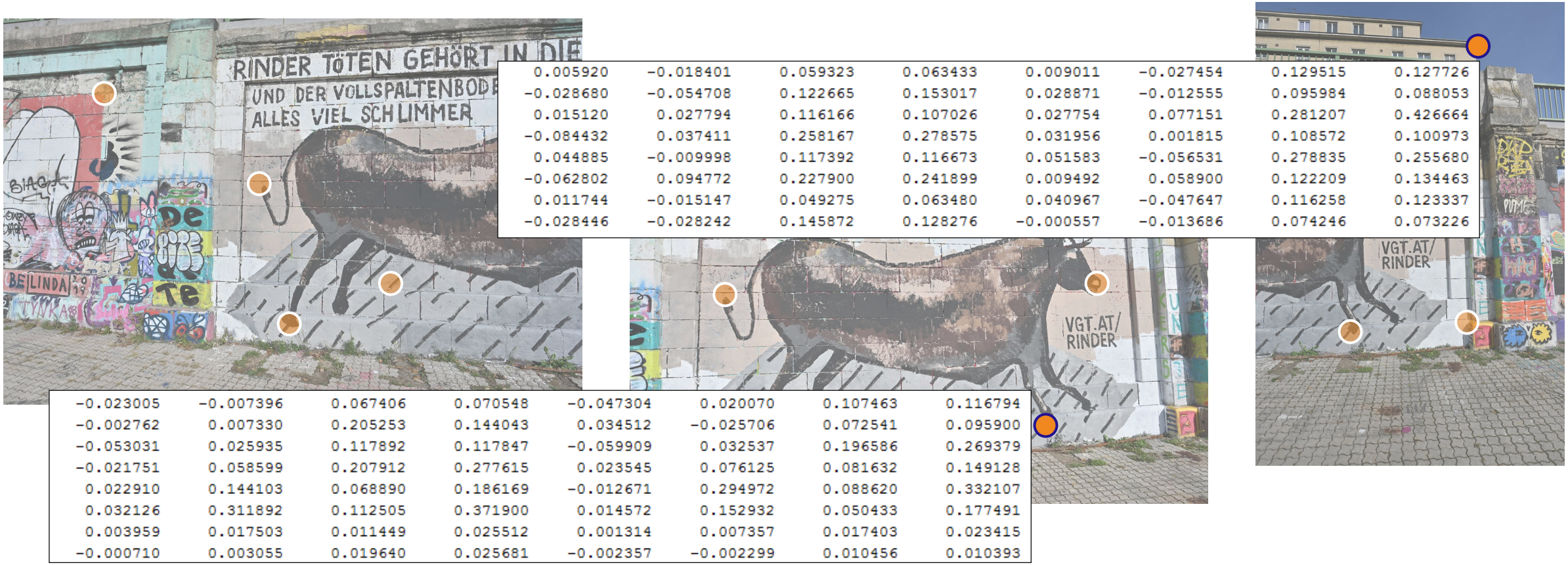
STRUCTURE from motion

DETECT *FEATURES*

STRUCTURE from motion

DESCRIBE *FEATURES*

STRUCTURE from motion



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-0.028680	-0.054708	0.122665	0.153017	0.028871	-0.012555	0.095984	0.088053
0.015120	0.027794	0.116166	0.107026	0.027754	0.077151	0.281207	0.426664
-0.084432	0.037411	0.258167	0.278575	0.031956	0.001815	0.108572	0.100973
0.044885	-0.009998	0.117392	0.116673	0.051583	-0.056531	0.278835	0.255680
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0.032126	0.311892	0.112505	0.371900	0.014572	0.152932	0.050433	0.177491
0.003959	0.017503	0.011449	0.025512	0.001314	0.007357	0.017403	0.023415
-0.000710	0.003055	0.019640	0.025681	-0.002357	-0.002299	0.010456	0.010393

DESCRIBE *FEATURES*

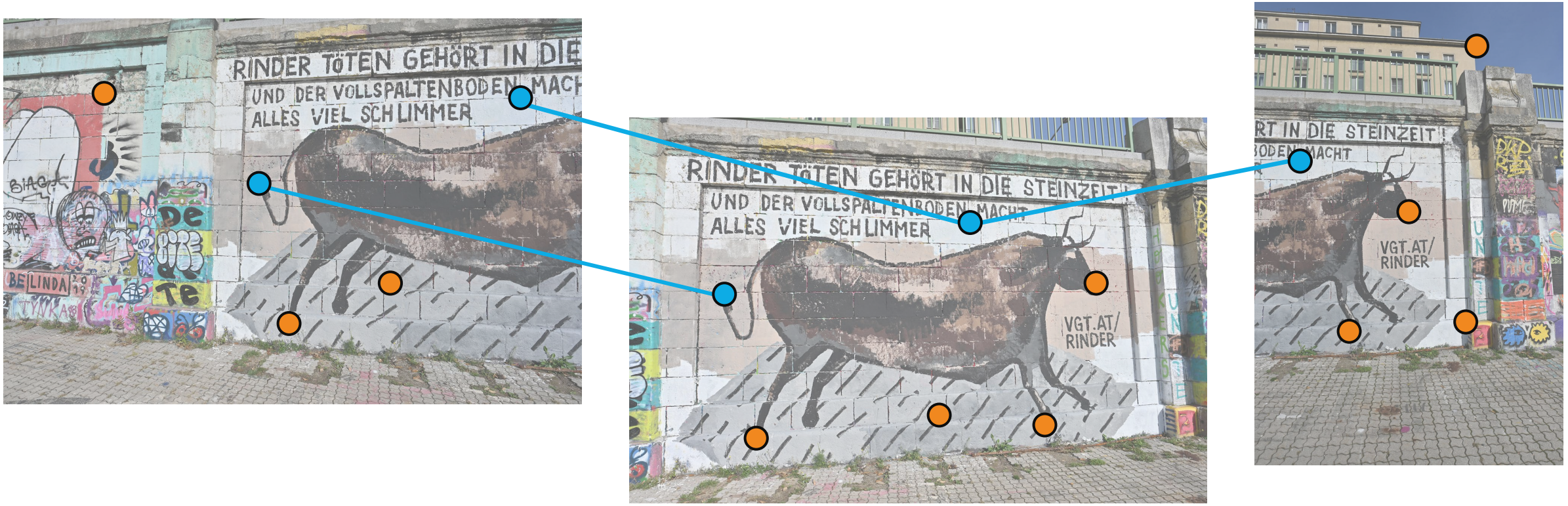
STRUCTURE from motion

MATCH *DESCRIPTORS*

STRUCTURE from motion

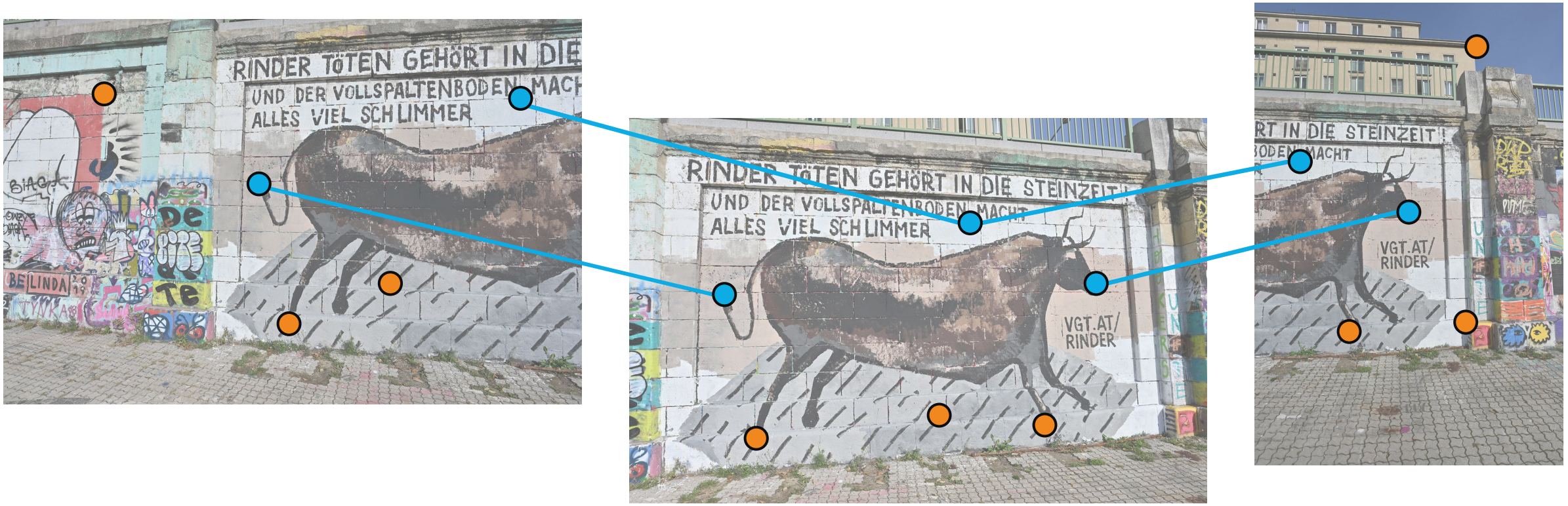
MATCH *DESCRIPTORS*

STRUCTURE from motion



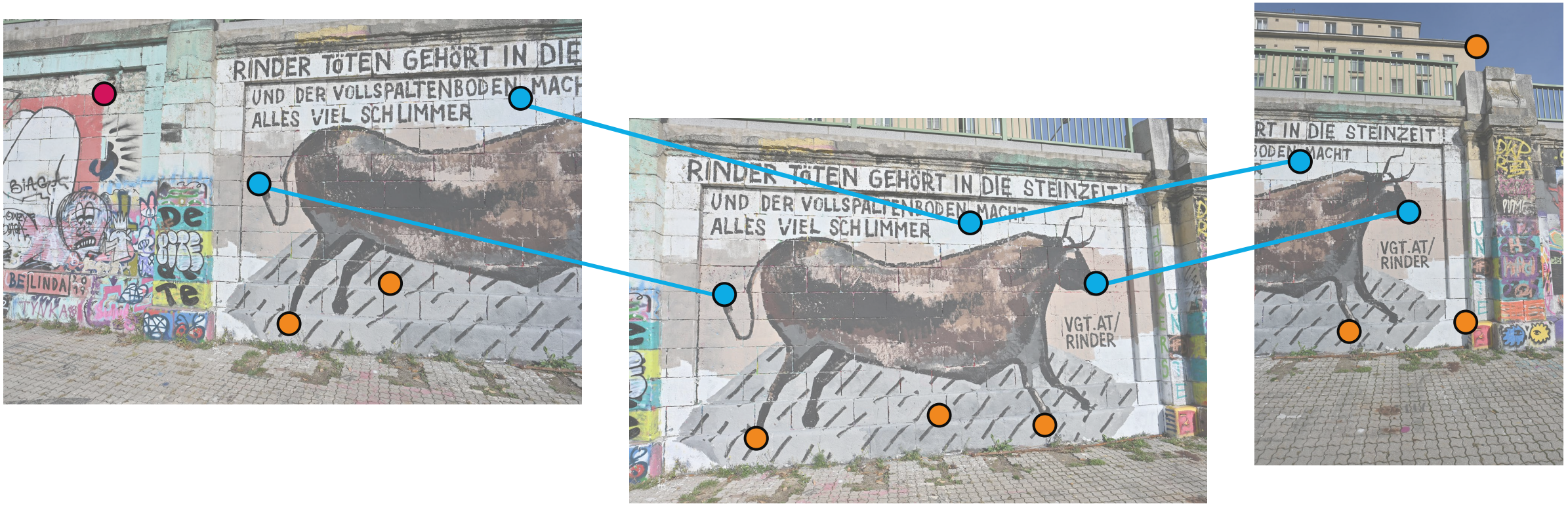
MATCH *DESCRIPTORS*

STRUCTURE from motion



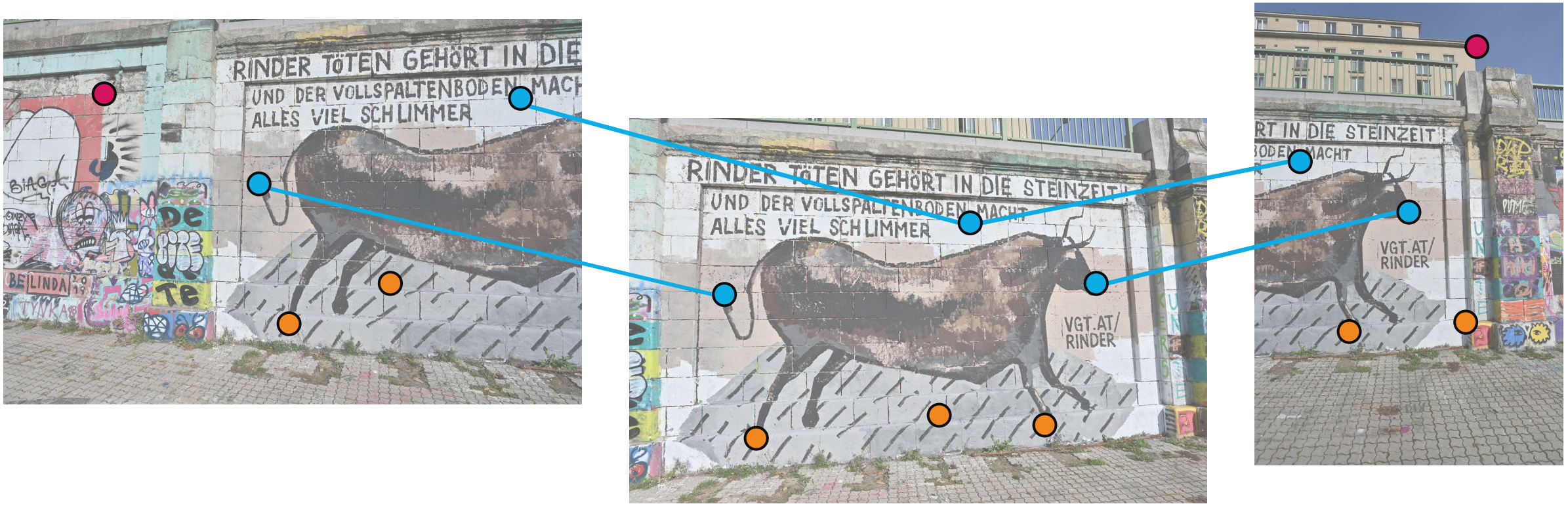
MATCH *DESCRIPTORS*

STRUCTURE from motion



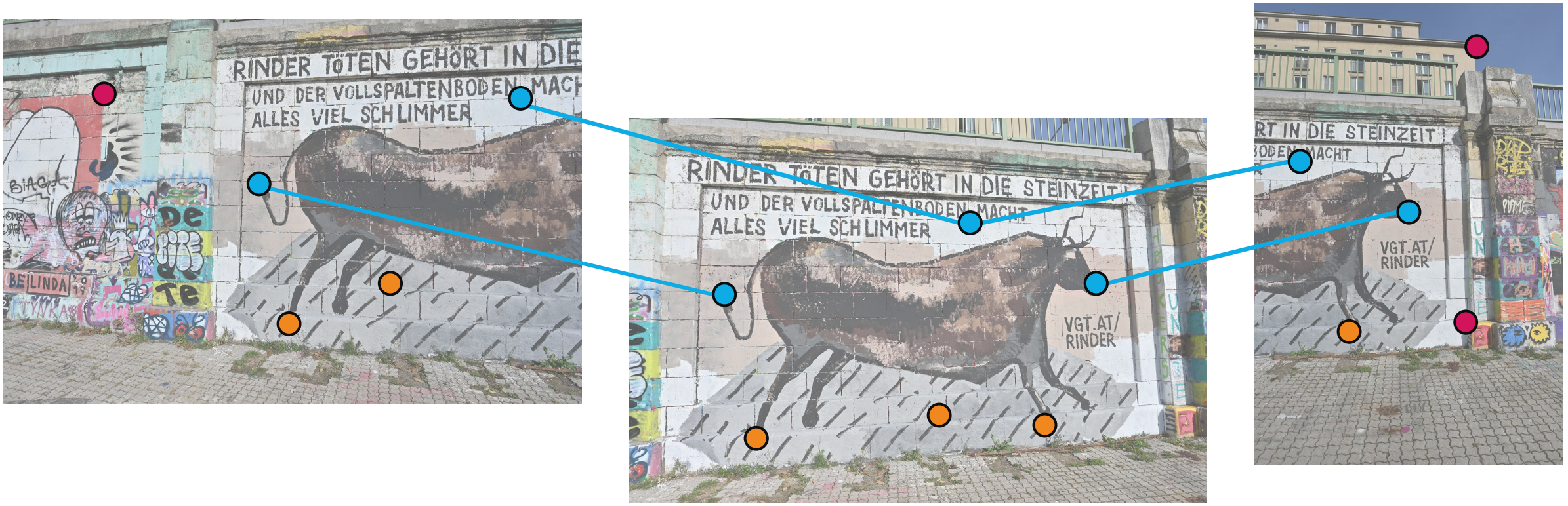
MATCH *DESCRIPTORS*

STRUCTURE from motion



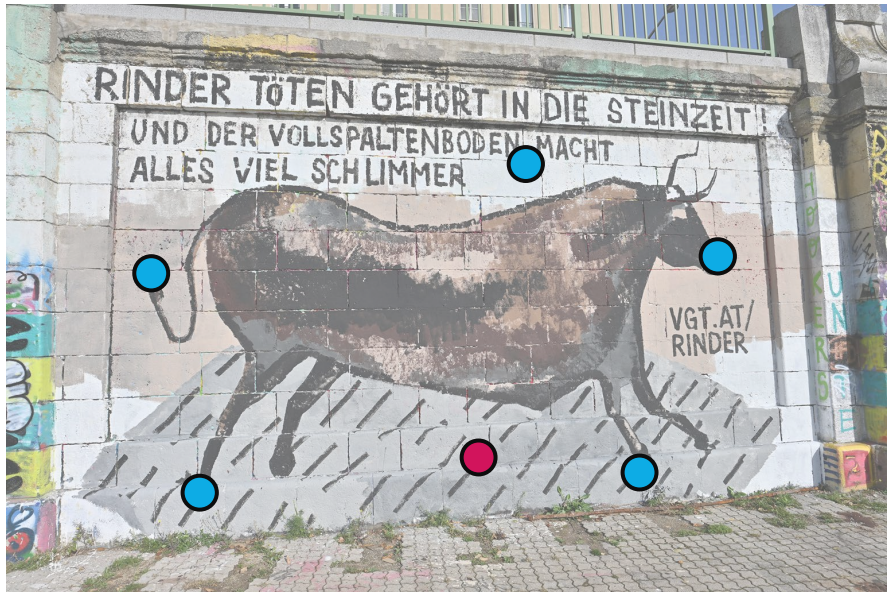
MATCH *DESCRIPTORS*

STRUCTURE from motion



MATCH *DESCRIPTORS*

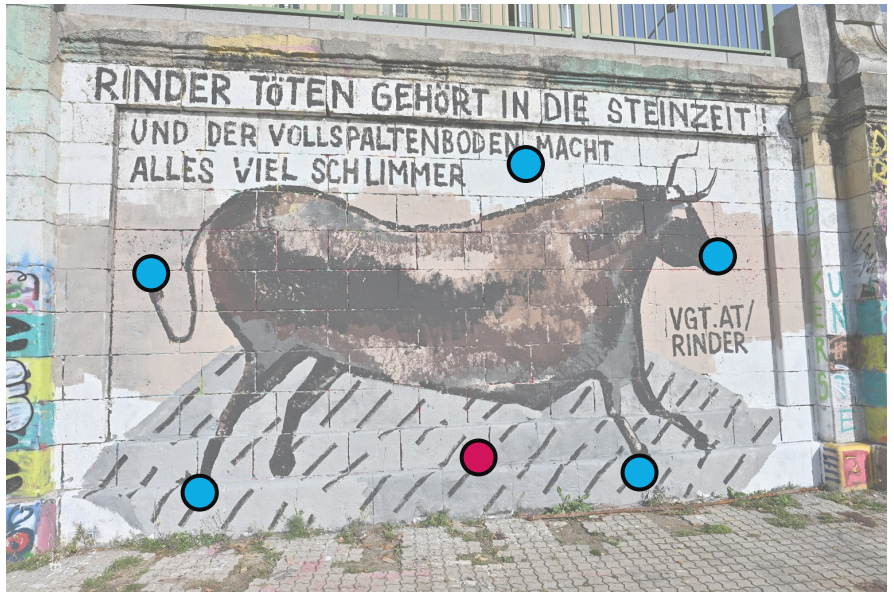
STRUCTURE from motion



MATCH *DESCRIPTORS*

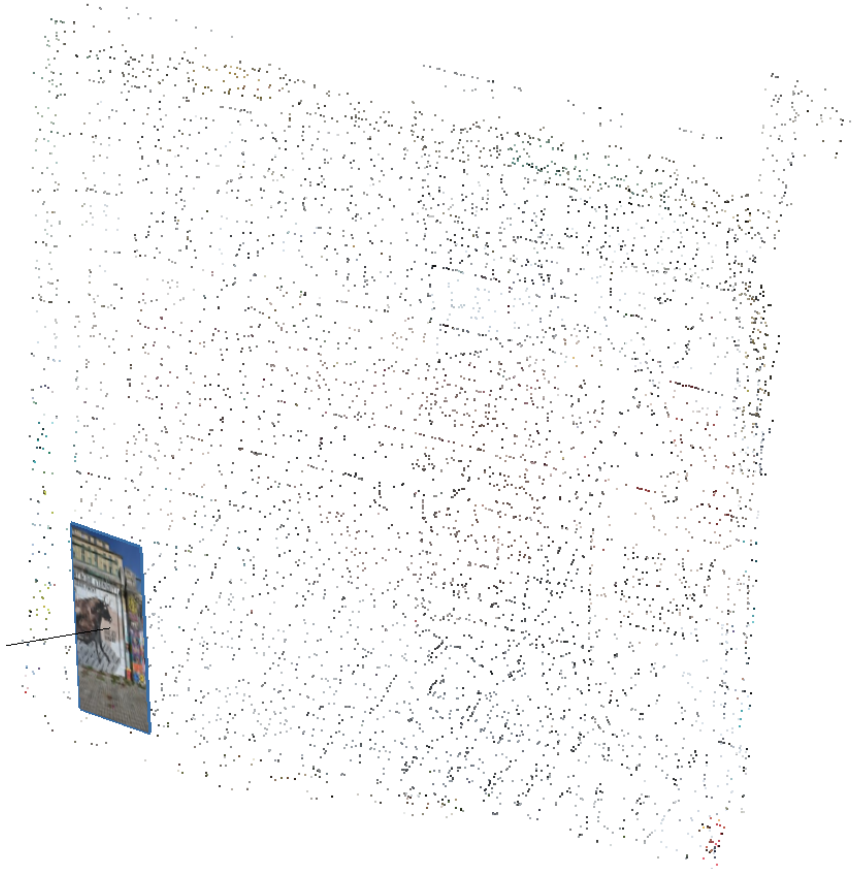
STRUCTURE from motion

TIE POINTS



STRUCTURE from motion

TIE POINTS

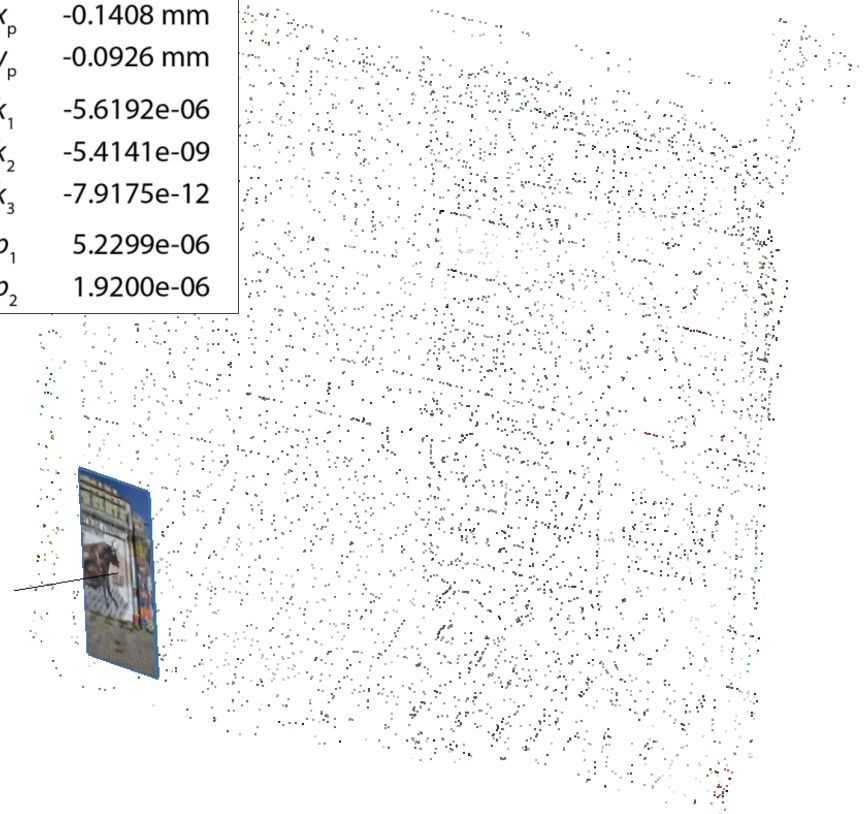


ESTIMATE *CAMERA EXTERIOR ORIENTATION*

STRUCTURE from motion

TIE POINTS

principal distance	c	20.1546 mm
principal point location	x_p	-0.1408 mm
	y_p	-0.0926 mm
radial distortion parameters	k_1	-5.6192e-06
	k_2	-5.4141e-09
	k_3	-7.9175e-12
decentring distortion parameters	p_1	5.2299e-06
	p_2	1.9200e-06



ESTIMATE *CAMERA EXTERIOR ORIENTATION*

ESTIMATE *CAMERA INTERIOR ORIENTATION*

STRUCTURE from motion

TIE POINTS

principal distance	c	20.1546 mm
principal point location	x_p	-0.1408 mm
	y_p	-0.0926 mm
radial distortion parameters	k_1	-5.6192e-06
	k_2	-5.4141e-09
	k_3	-7.9175e-12
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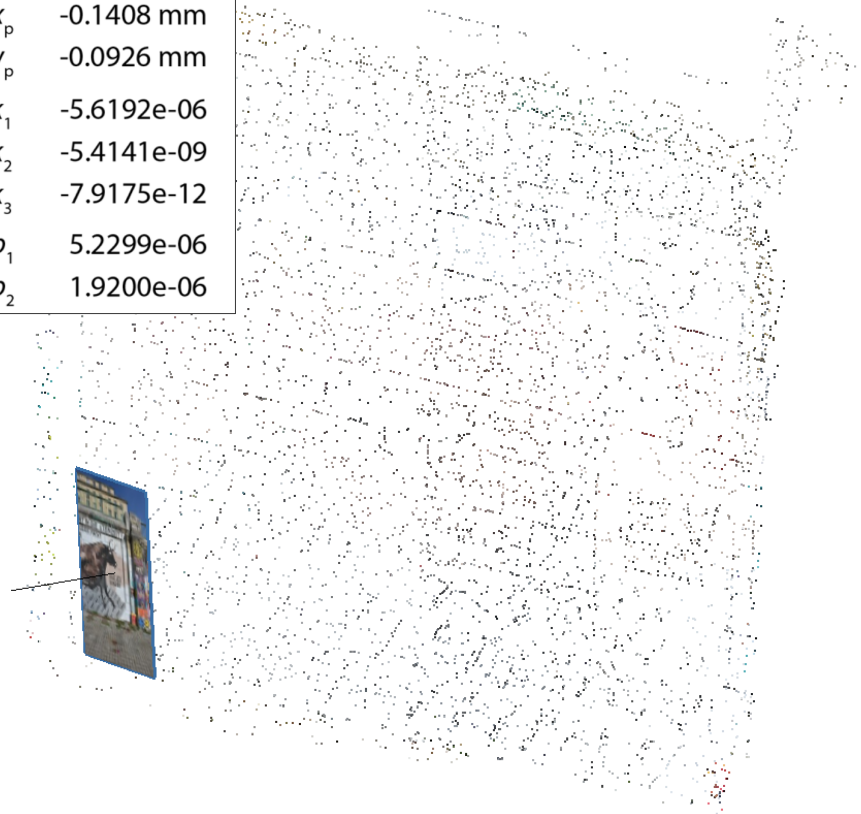


3D POINTS

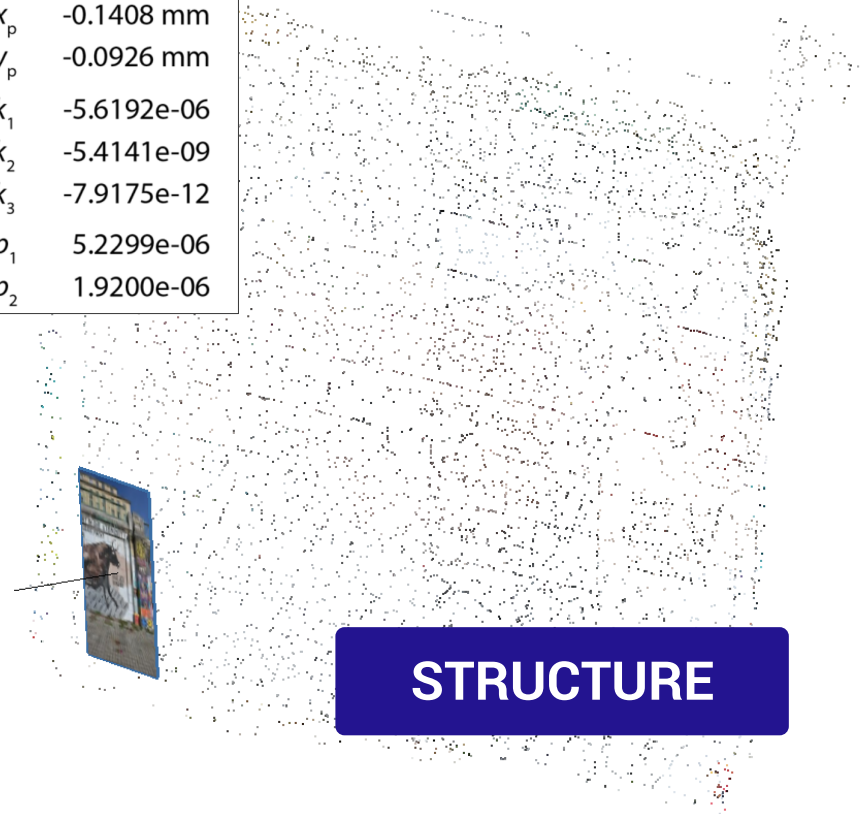
ESTIMATE *CAMERA EXTERIOR ORIENTATION*

ESTIMATE *CAMERA INTERIOR ORIENTATION*

STRUCTURE from motion

TIE POINTS

principal distance	c	20.1546 mm
principal point location	x_p	-0.1408 mm
	y_p	-0.0926 mm
radial distortion parameters	k_1	-5.6192e-06
	k_2	-5.4141e-09
	k_3	-7.9175e-12
decentring distortion parameters	p_1	5.2299e-06
	p_2	1.9200e-06



STRUCTURE

3D POINTS

ESTIMATE *CAMERA EXTERIOR ORIENTATION*

ESTIMATE *CAMERA INTERIOR ORIENTATION*

and
STRUCTURE from motion

TIE POINTS

principal distance	c	20.1546 mm
principal point location	x_p	-0.1408 mm
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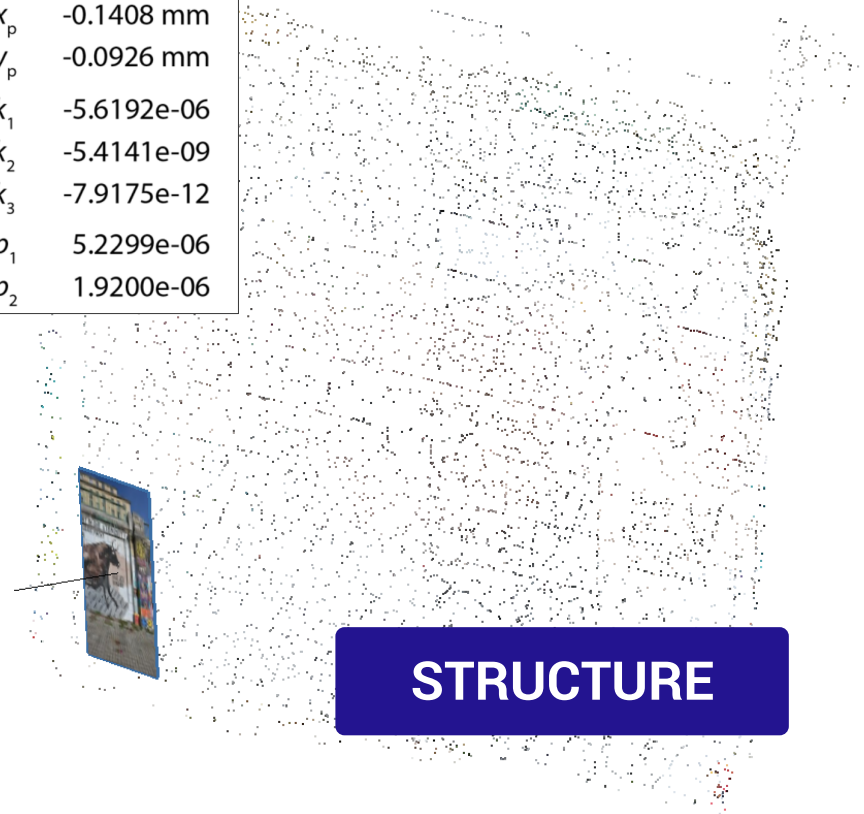
radial distortion parameters	k_1	-5.6192e-06
	k_2	-5.4141e-09
	k_3	-7.9175e-12
decentring distortion parameters	p_1	5.2299e-06
	p_2	1.9200e-06



STRUCTURE

3D POINTS

ESTIMATE *CAMERA EXTERIOR ORIENTATION*

ESTIMATE *CAMERA INTERIOR ORIENTATION*

STRUCTURE from motion

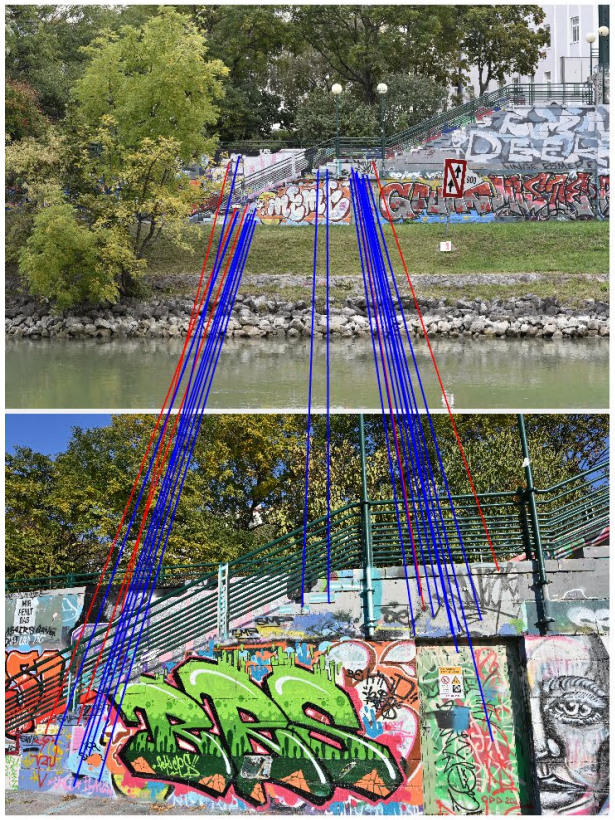
CAMERA EXTERIOR ORIENTATION

CAMERA INTERIOR ORIENTATION

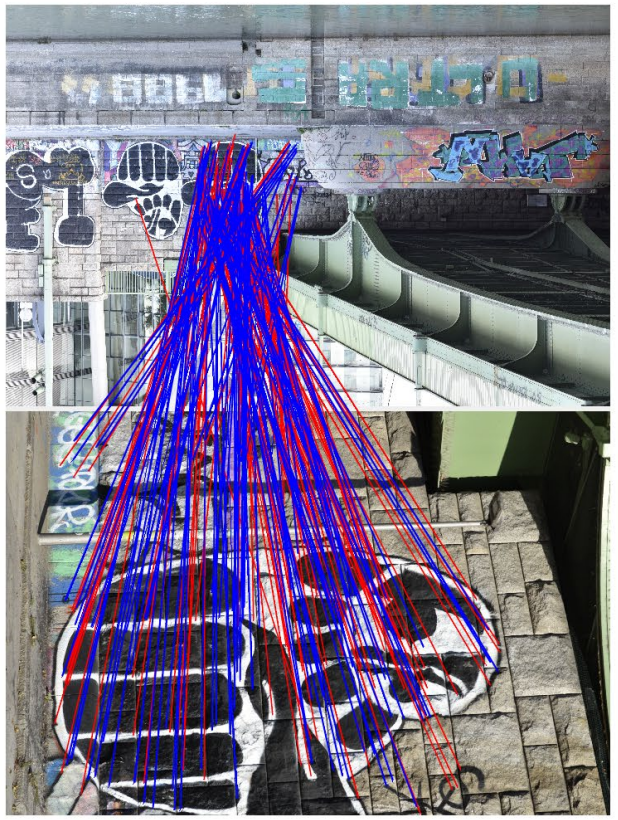
3D POINTS

CAMERA orientation

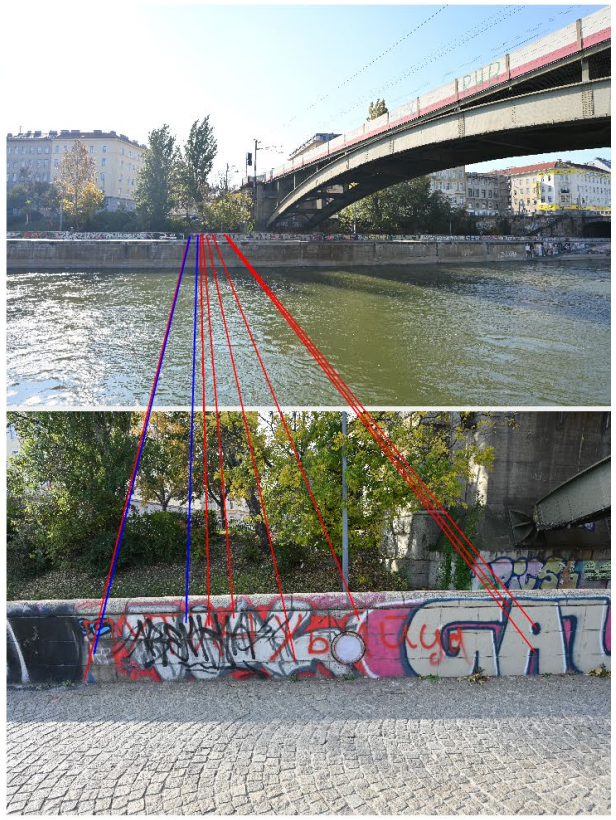
Nikon D750 + 85 mm
30-09-2021



Nikon D750 + 85 mm
30-09-2021



Nikon Z7 II + 20 mm
28-10-2021

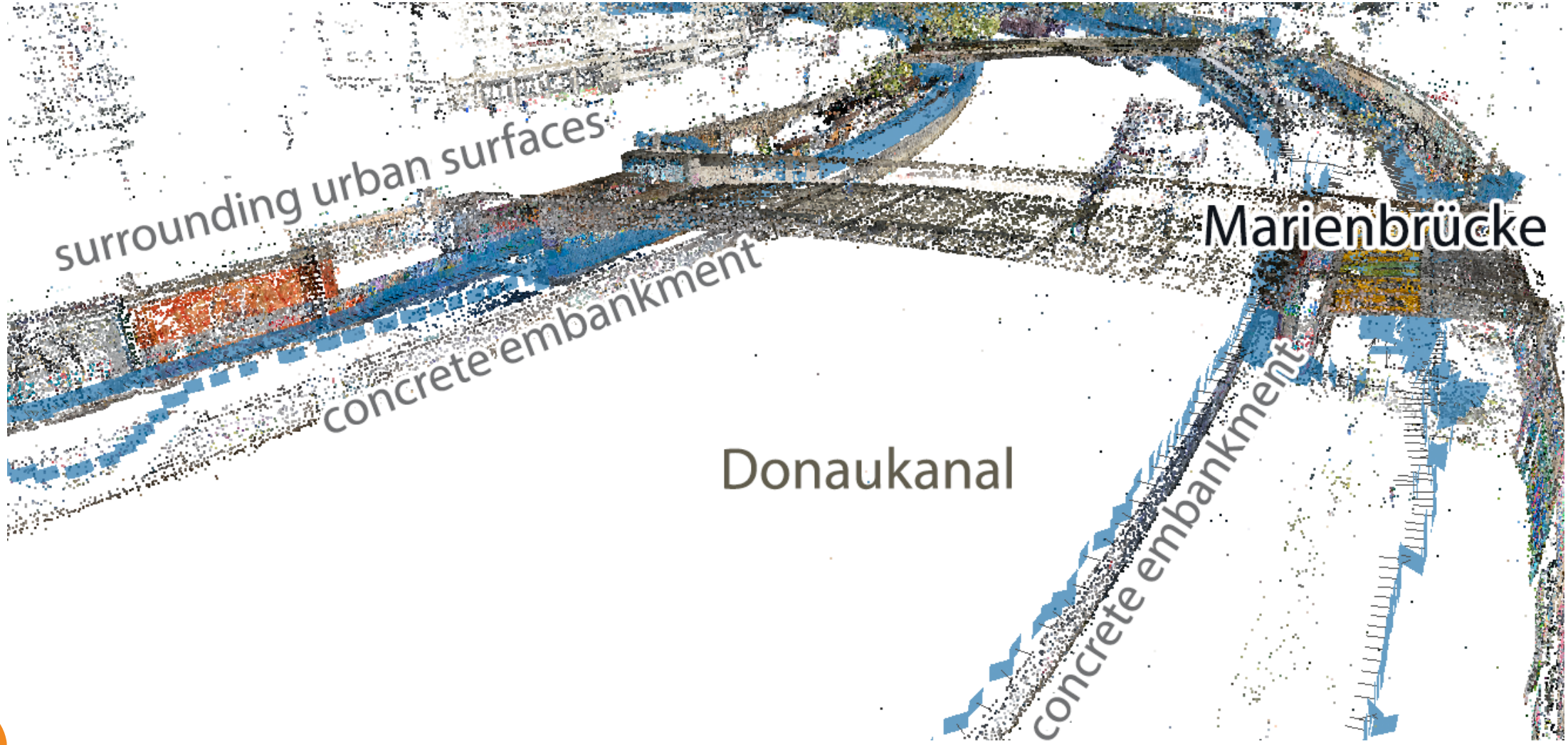


Nikon Z7 II + 20 mm
29-10-2021

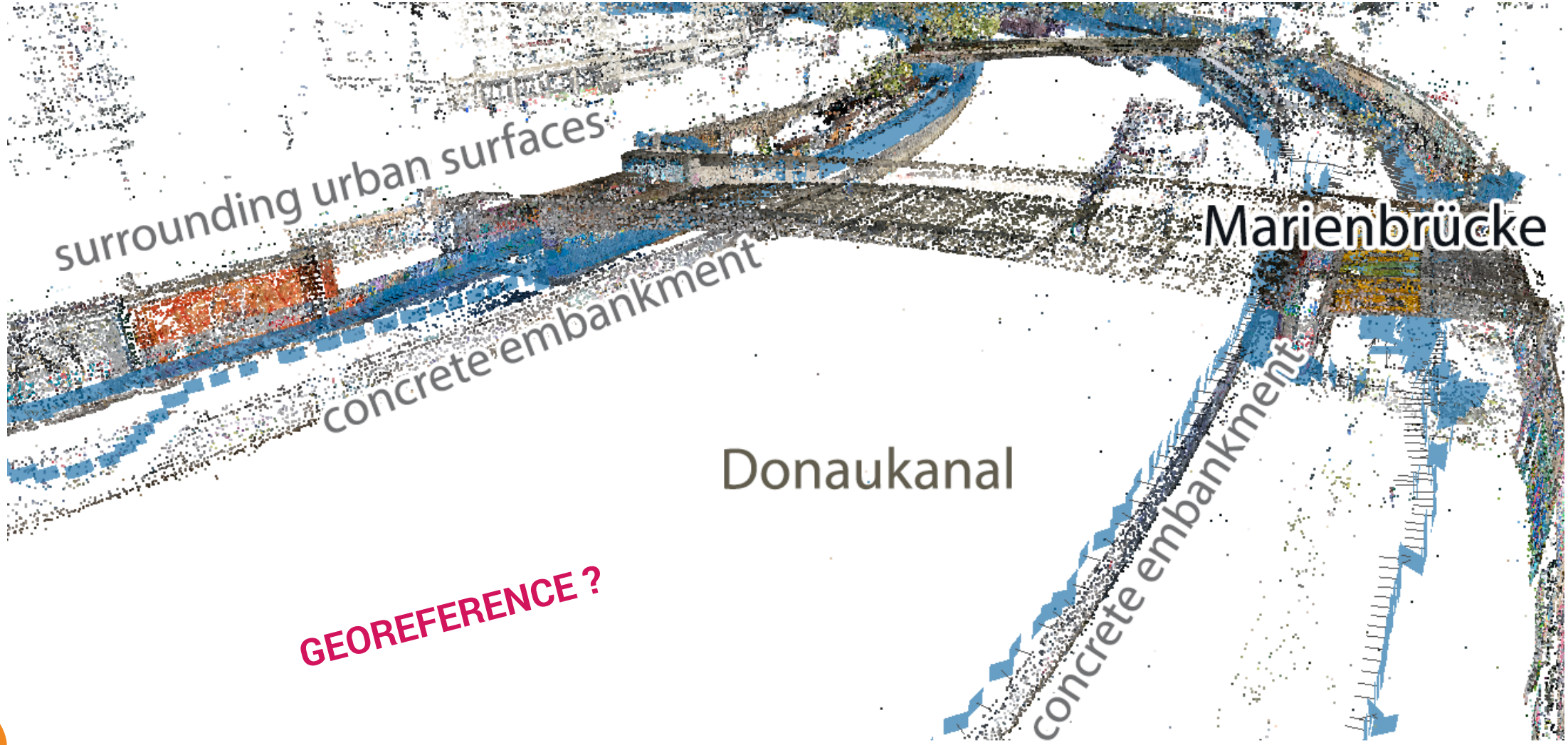
Nikon D750 + 85 mm
01-10-2021

Nikon Z7 II + 20 mm
26-10-2021

CAMERA orientation



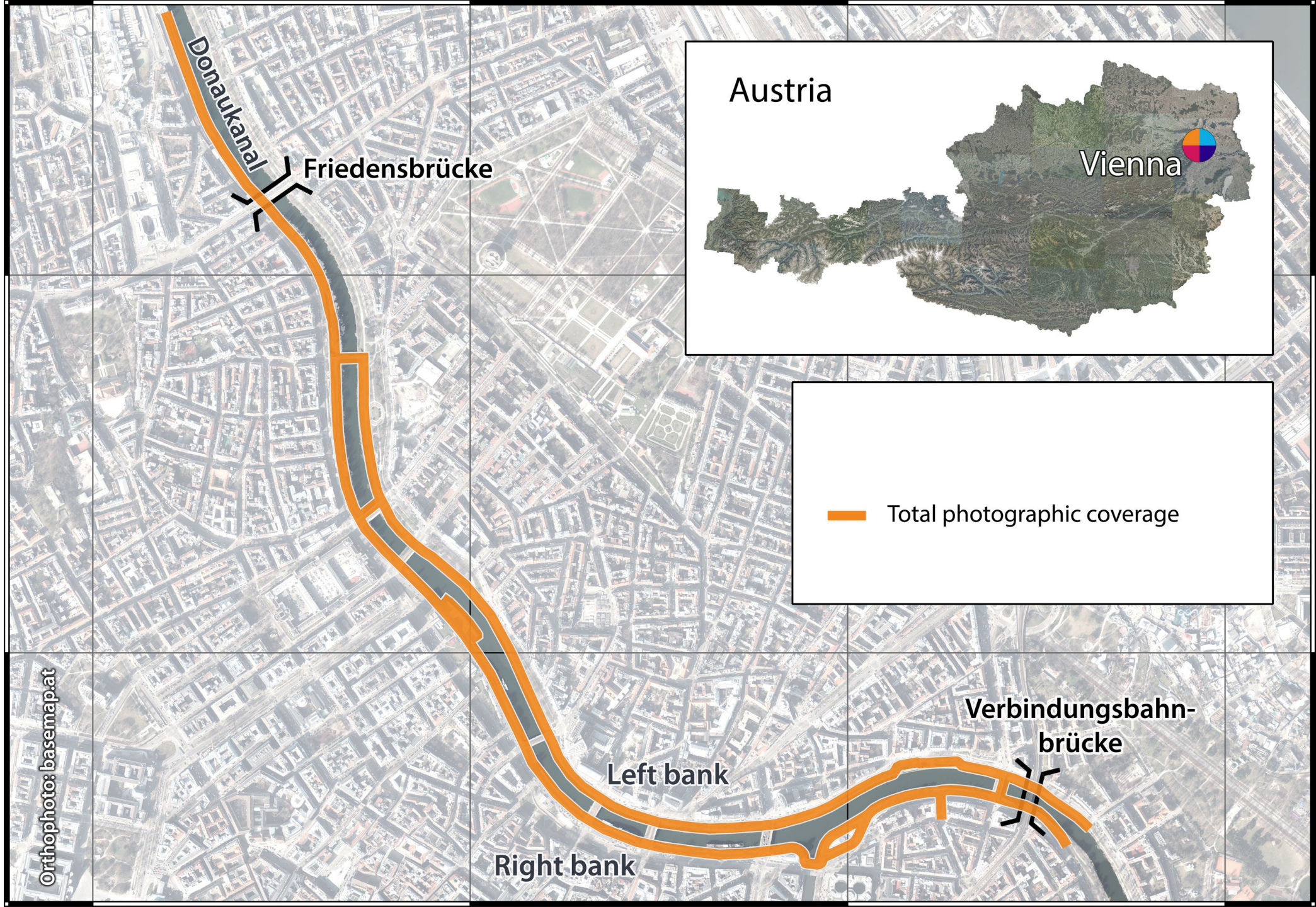
CAMERA orientation



GEOREFERENCE ?

TOTAL COVERAGE

14.0 km

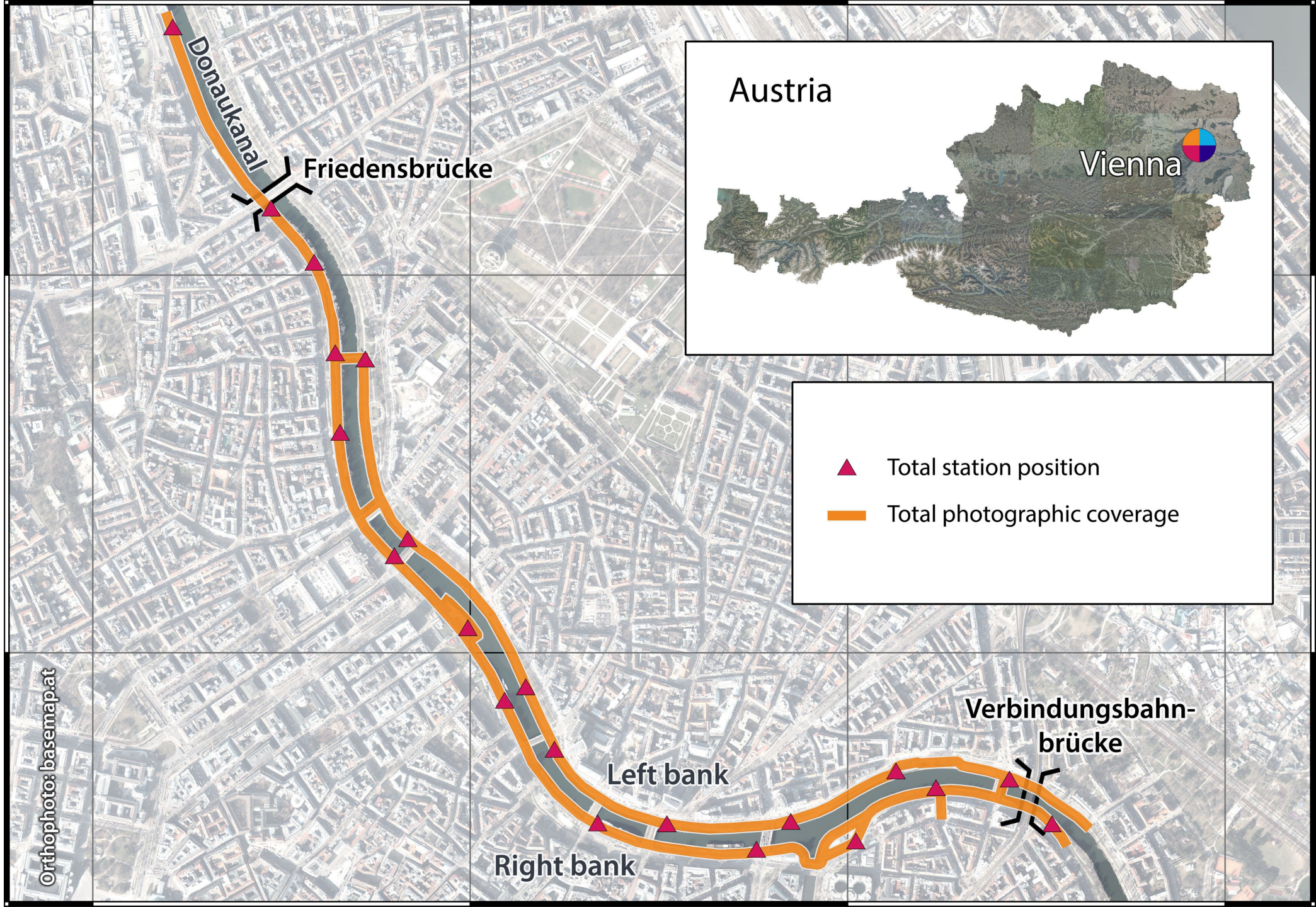


TOTAL COVERAGE

14.0 km

TOTAL STATION POSITIONS

21



TOTAL COVERAGE

14.0 km

TOTAL STATION POSITIONS

21

TOTAL COVERAGE

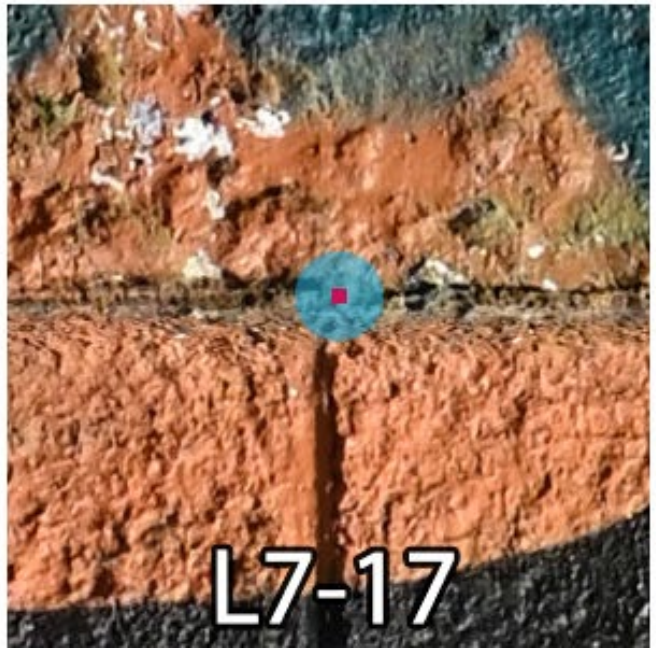
14.0 km

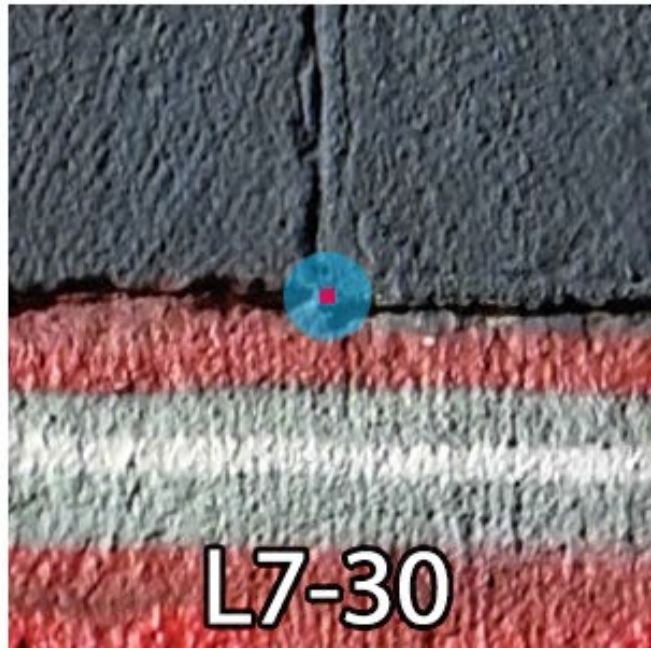
TOTAL STATION POSITIONS

21

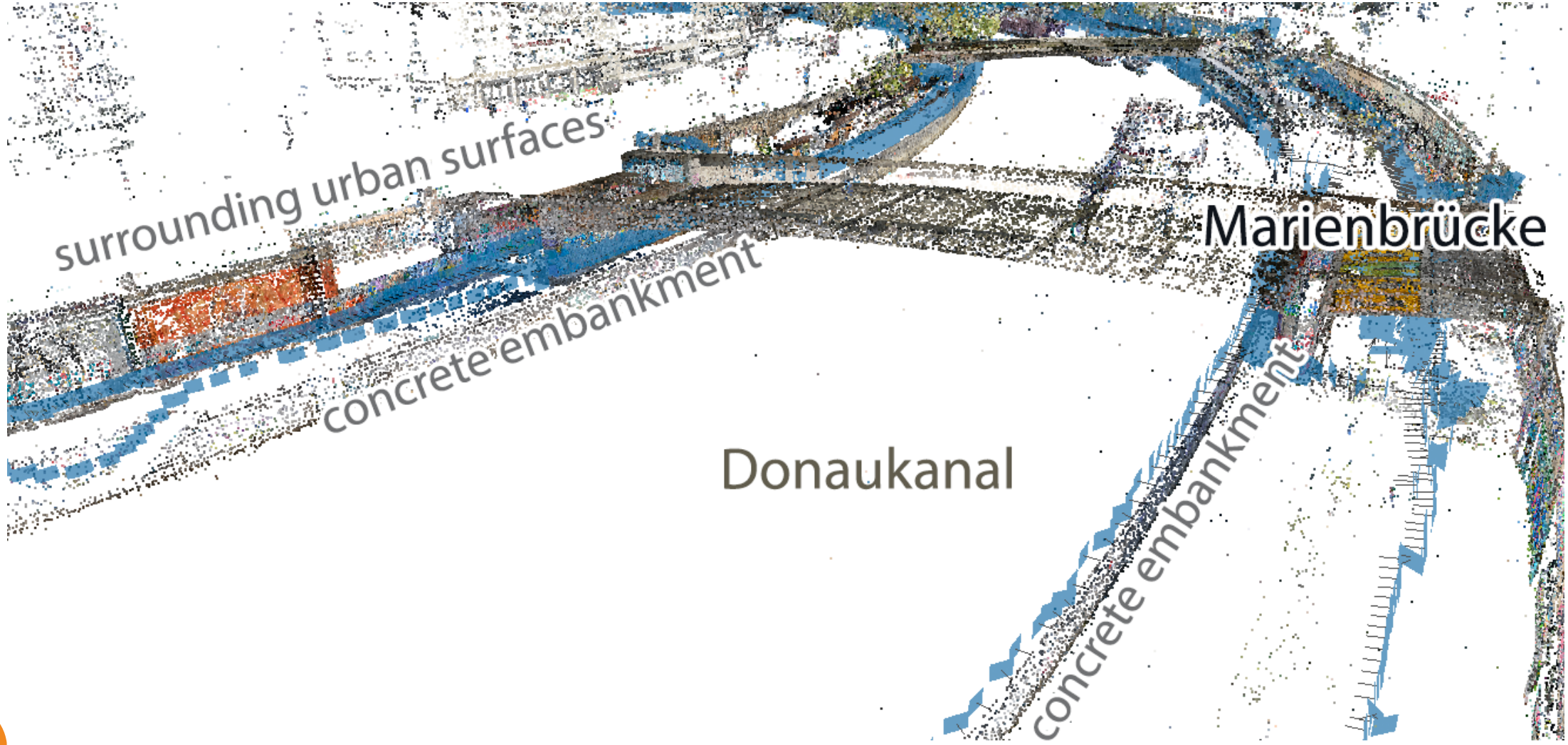
GRAFFITI-SCAPE POINTS

624

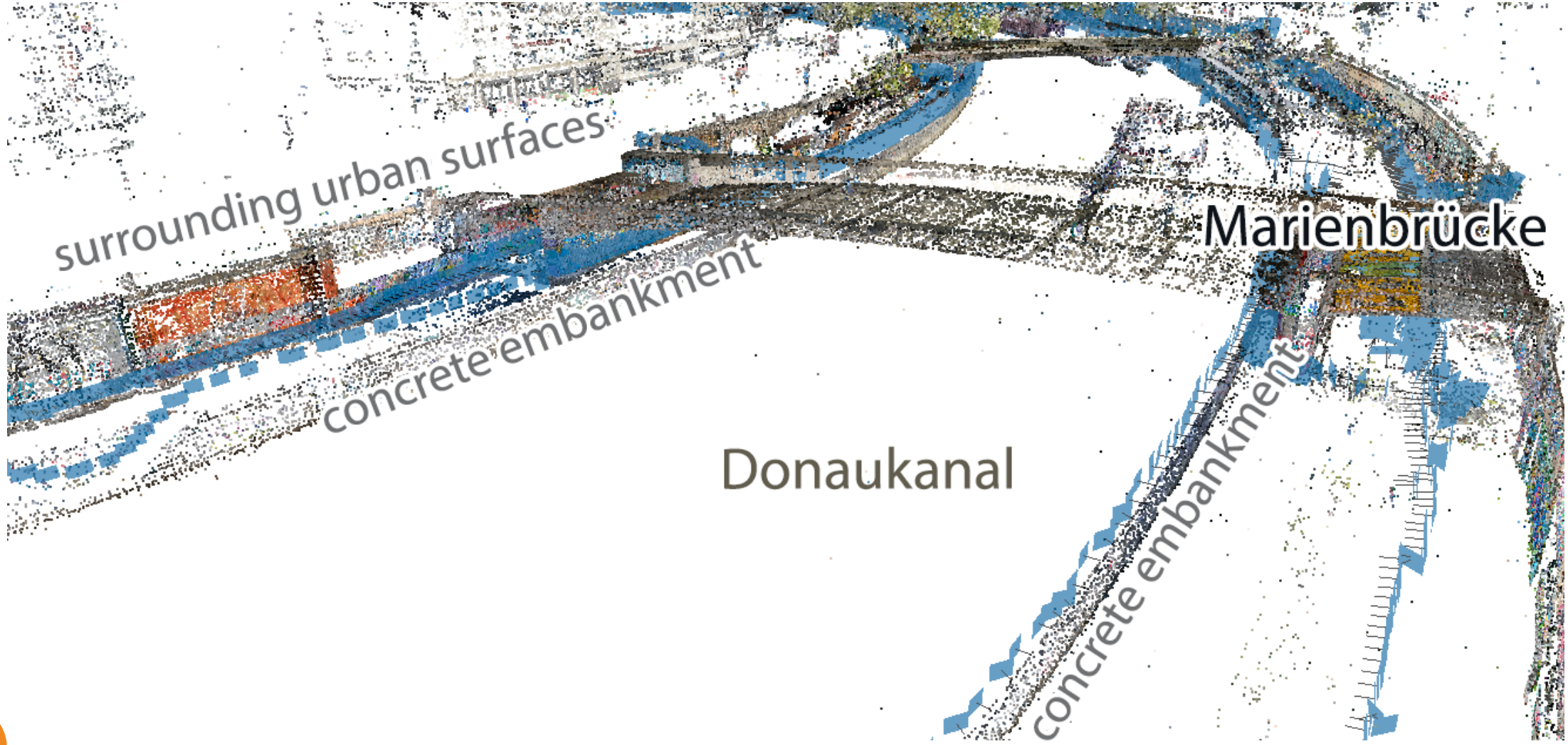




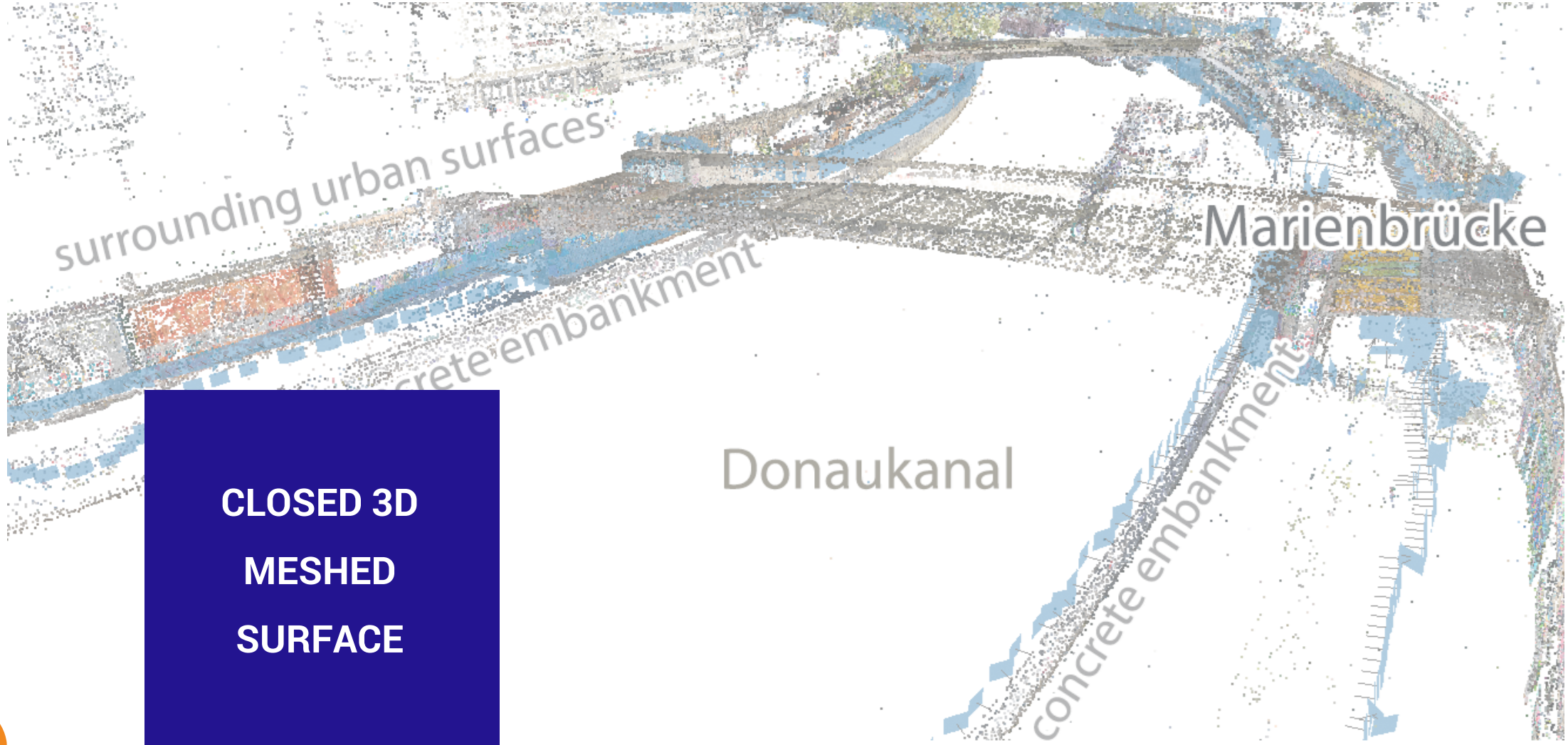
CAMERA orientation



THREE purposes

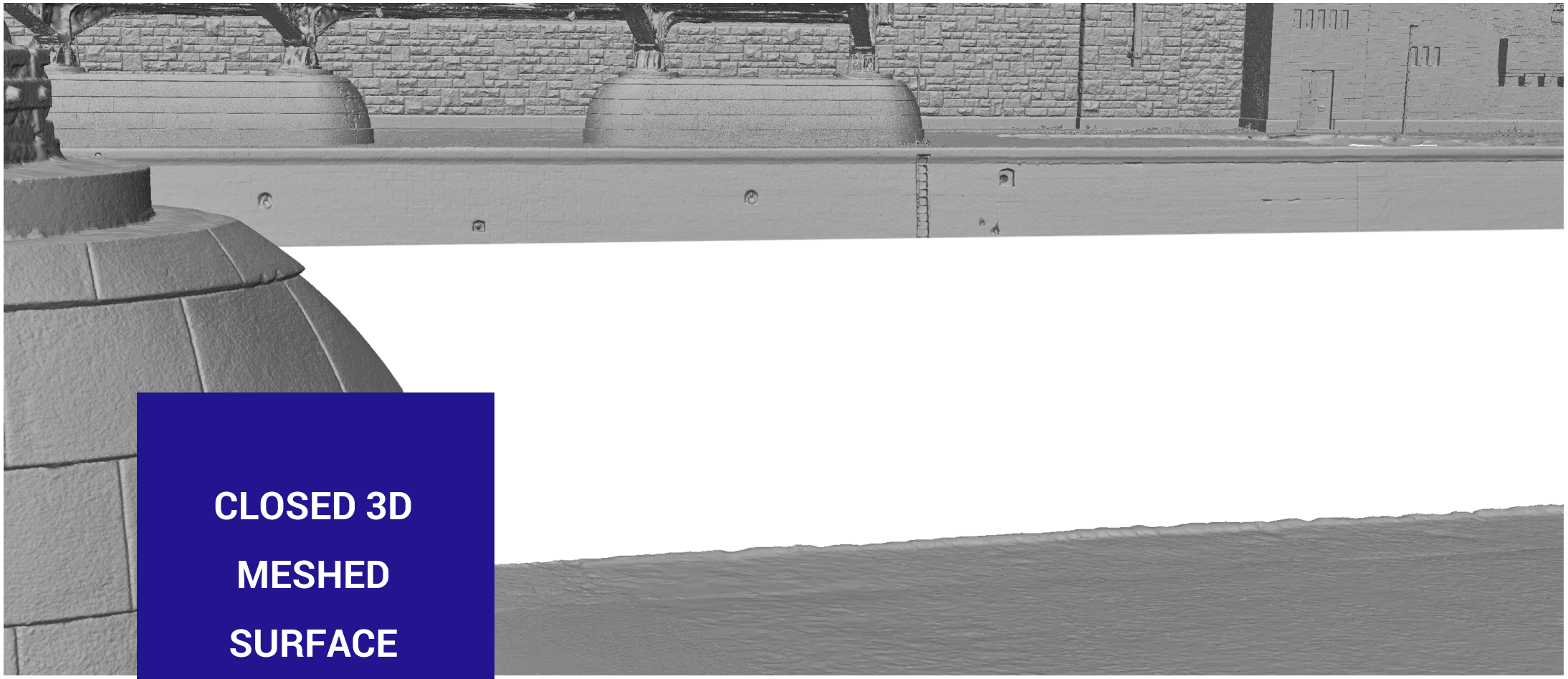


THREE purposes



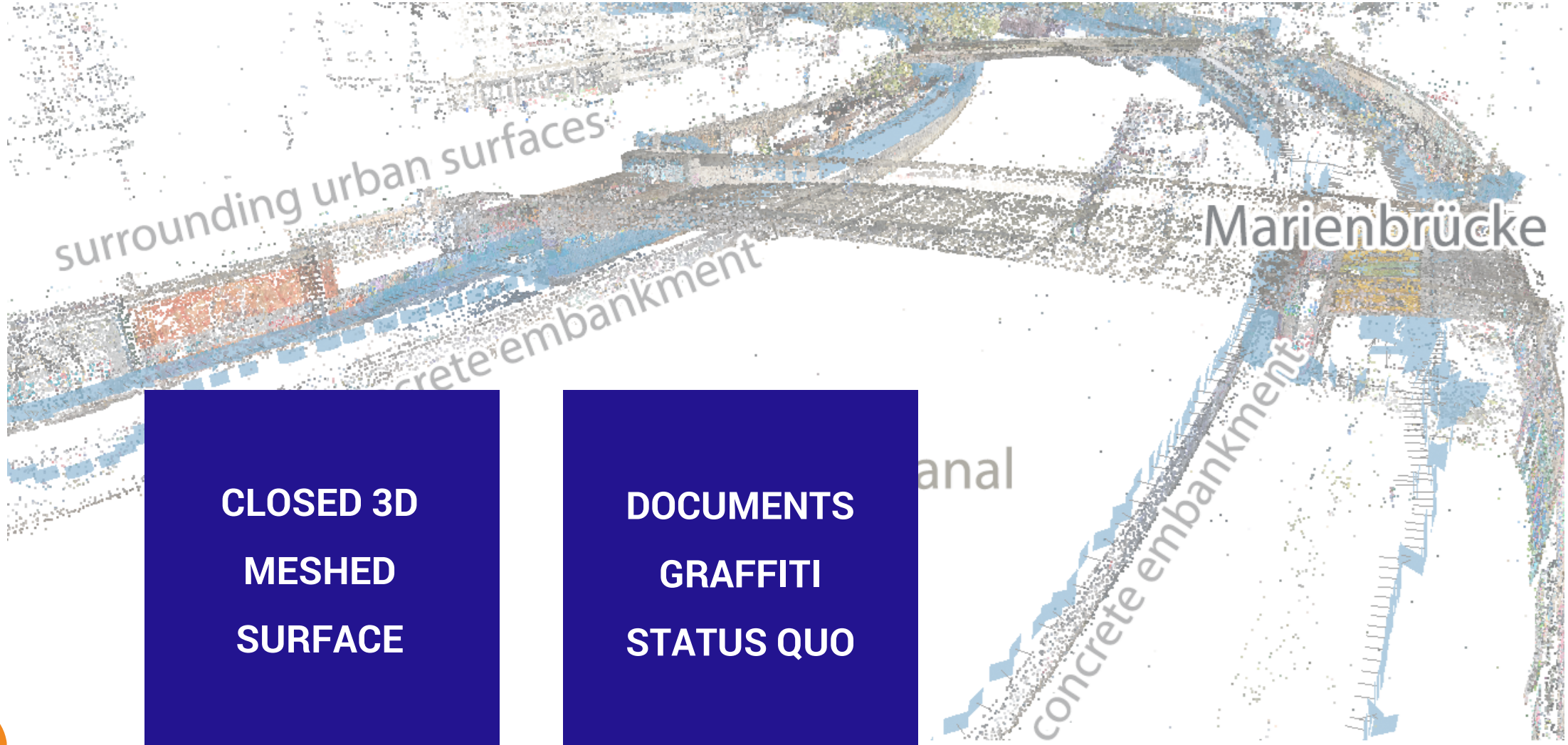
CLOSED 3D MESHED SURFACE

THREE purposes



CLOSED 3D MESHED SURFACE

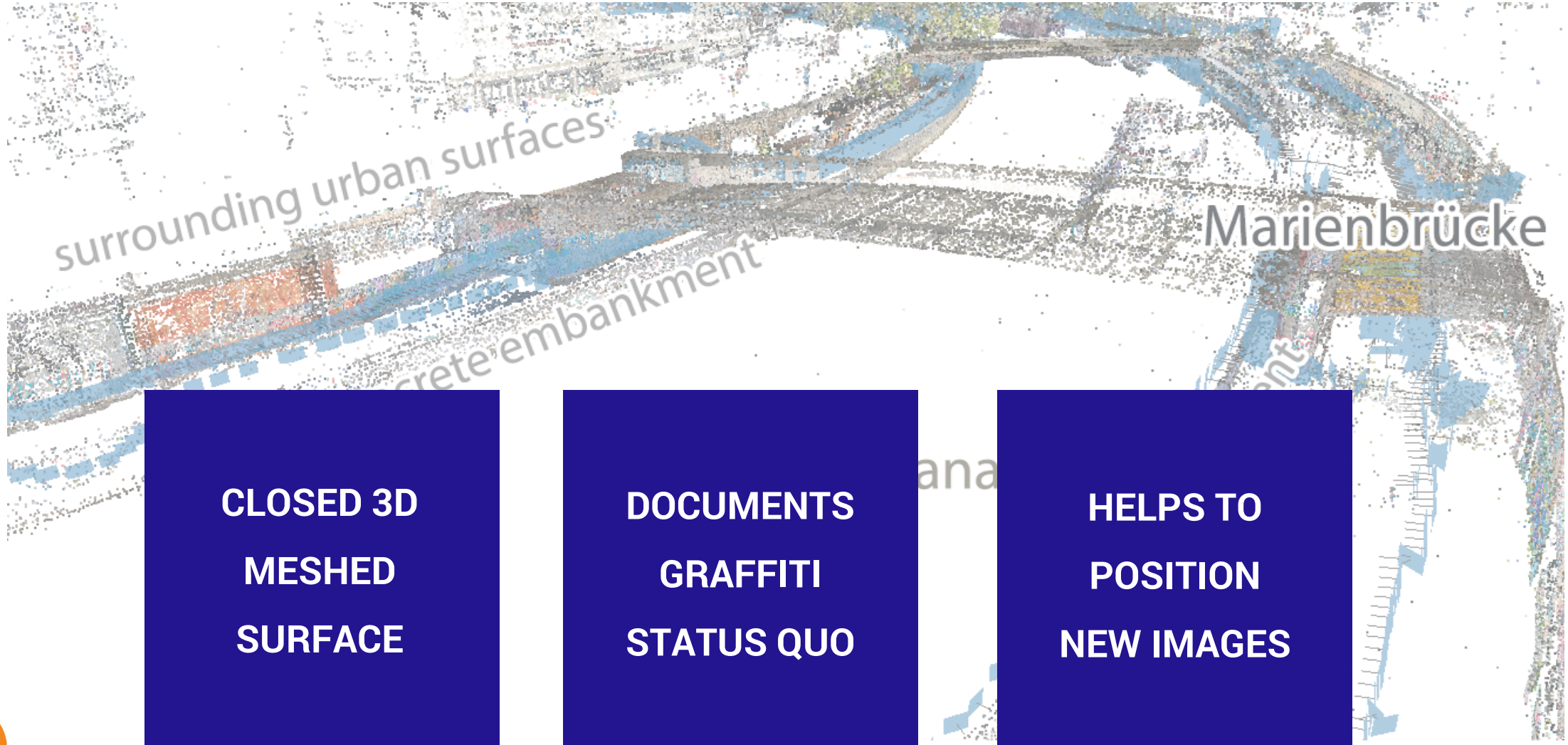
THREE purposes



CLOSED 3D MESHED SURFACE

DOCUMENTS GRAFFITI STATUS QUO

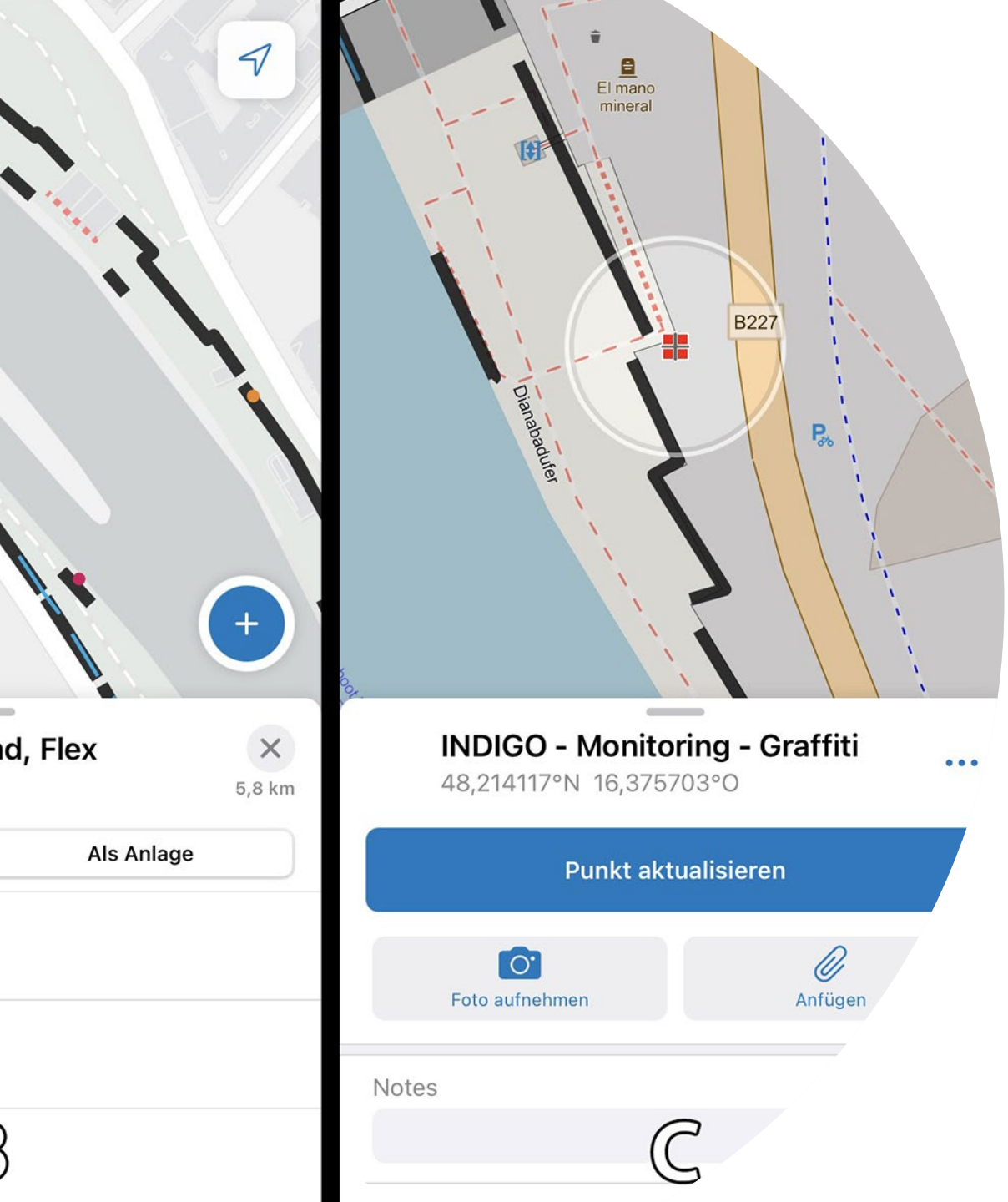
THREE purposes



CLOSED 3D MESHED SURFACE

DOCUMENTS GRAFFITI STATUS QUO

HELPS TO POSITION NEW IMAGES



FOLLOW-UP
photography

Instagram + monitoring app

FOLLOW-UP
photography

Instagram + monitoring app

2 photographers

FOLLOW-UP
photography

Instagram + monitoring app

2 photographers

2 cameras + 2 spectrometers + 2 tablets

identically programmed

FOLLOW-UP
photography

Instagram + monitoring app

2 photographers

2 cameras + 2 spectrometers + 2 tablets

identically programmed

fixed acquisition procedure


Hardware
relies on
'Follow-up' workflow
generates
Output
has
Purpose

Hardware *relies on* 'Follow-up' workflow *generates* Output *has* Purpose

Check the map

Hardware *relies on* 'Follow-up' workflow *generates* Output *has* Purpose

Check the map

↓

Move to closest new graffito

Hardware *relies on* 'Follow-up' workflow *generates* Output *has* Purpose

- Check the map
- Move to closest new graffito
- Focus on ColorChecker

Hardware *relies on* 'Follow-up' workflow *generates* Output *has* Purpose

Check the map

↓

Move to closest new graffito

↓

Focus on ColorChecker

↓

Photograph ColorChecker

1 ColorChecker photo

1. Subdivide photo series

Hardware	relies on	'Follow-up' workflow	generates	Output	has	Purpose

Check the map

↓

Move to closest new graffito

↓

Focus on ColorChecker

↓

Photograph ColorChecker

↓

Measure illumination

1 ColorChecker photo

1 illumination spectrum

1. Subdivide photo series
2. Establish link with spectrometer file
3. Generate correct photo colours (backup)

Generate correct photo colours

Hardware	relies on	'Follow-up' workflow	generates	Output	has	Purpose

Check the map

↓

Move to closest new graffito

↓

Focus on ColorChecker

↓

Photograph ColorChecker

↓

Measure illumination

↓

large graffito → Move maximum 3 m away from graffito

small graffito → Move maximum 2 m away from graffito

↓

Focus on graffito

1 ColorChecker photo

1 illumination spectrum

1. Subdivide photo series
2. Establish link with spectrometer file
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Hardware	relies on	'Follow-up' workflow	generates	Output	has	Purpose

Check the map

↓

Move to closest new graffito

↓

Focus on ColorChecker

↓

Photograph ColorChecker

↓

Measure illumination

↓

large graffito → Move maximum 3 m away from graffito

small graffito → Move maximum 2 m away from graffito

↓

Focus on graffito

↓

Move farther away / Move closer or farther

↓

Acquire overview photo

1 ColorChecker photo

1 illumination spectrum

1. Subdivide photo series
2. Establish link with spectrometer file
3. Generate correct photo colours (backup)

Generate correct photo colours

1 overview photo

1. Extract graffito outlines
2. Generate tour overview photos
3. Estimate interior & exterior camera orientations

Hardware	relies on	'Follow-up' workflow	generates	Output	has	Purpose

Check the map

Move to closest new graffito

Focus on ColorChecker

Photograph ColorChecker

Measure illumination

large graffito / *small graffito*

Move maximum 3 m away from graffito

Move maximum 2 m away from graffito

Focus on graffito

Move farther away

Move closer or farther

Acquire overview photo

Move again to 3 m from graffito

Move again to 2 m from graffito

Acquire strong network of many overlapping photos of the graffito and its surroundings

1 ColorChecker photo

1 illumination spectrum

1. Subdivide photo series
2. Establish link with spectrometer file
3. Generate correct photo colours (backup)

Generate correct photo colours

1 overview photo

1. Extract graffito outlines
2. Generate tour overview photos
3. Estimate interior & exterior camera orientations

[5, ∞[detailed graffito photos

1. Estimate interior & exterior camera orientations
2. Produce 3D model texture
3. Generate orthophoto mosaic

Hardware	relies on	'Follow-up' workflow	generates	Output	has	Purpose

Check the map

Move to closest new graffito

Focus on ColorChecker

Photograph ColorChecker

Measure illumination

large graffito: Move maximum 3 m away from graffito

small graffito: Move maximum 2 m away from graffito

Focus on graffito

Move farther away

Move closer or farther

Acquire overview photo

Move again to 3 m from graffito

Move again to 2 m from graffito

Acquire strong network of many overlapping photos of the graffito and its surroundings

Update the map

1 ColorChecker photo

1 illumination spectrum

1. Subdivide photo series
2. Establish link with spectrometer file
3. Generate correct photo colours (backup)

Generate correct photo colours

1 overview photo

1. Extract graffito outlines
2. Generate tour overview photos
3. Estimate interior & exterior camera orientations

[5, ∞[detailed graffito photos

1. Estimate interior & exterior camera orientations
2. Produce 3D model texture
3. Generate orthophoto mosaic

Updated monitoring map

Guide follow-up photography

Hardware	relies on	'Follow-up' workflow	generates	Output	has	Purpose

Check the map

Move to closest new graffito

Focus on ColorChecker

Photograph ColorChecker

Measure illumination

large graffito / *small graffito*

Move maximum 3 m away from graffito / Move maximum 2 m away from graffito

Focus on graffito

Move farther away / Move closer or farther

Acquire overview photo

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Guide follow-up photography

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Focus on ColorChecker

Photograph ColorChecker

Measure illumination

large graffito

Move maximum 3 m away from graffito

small graffito

Move maximum 2 m away from graffito

Focus on graffito

Move farther away

Move closer or farther

Acquire overview photo

Move again to 3 m from graffito

Move again to 2 m from graffito

Acquire strong network of many overlapping photos of the graffito and its surroundings

Update the map

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1 illumination spectrum

1 overview photo

[5, ∞[detailed graffito photos

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Generate correct photo colours

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2. Generate tour overview photos
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2. Produce 3D model texture
3. Generate orthophoto mosaic

Guide follow-up photography

ACCURATE photo coordinates

ACCURATE photo coordinates

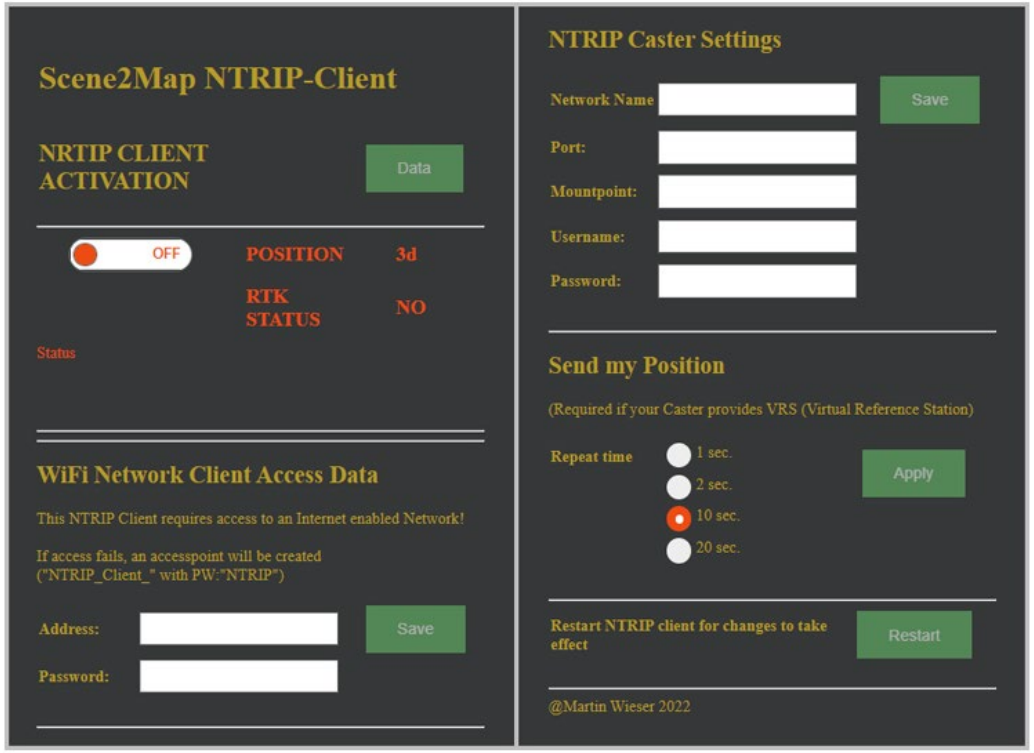


IMAGE positioning

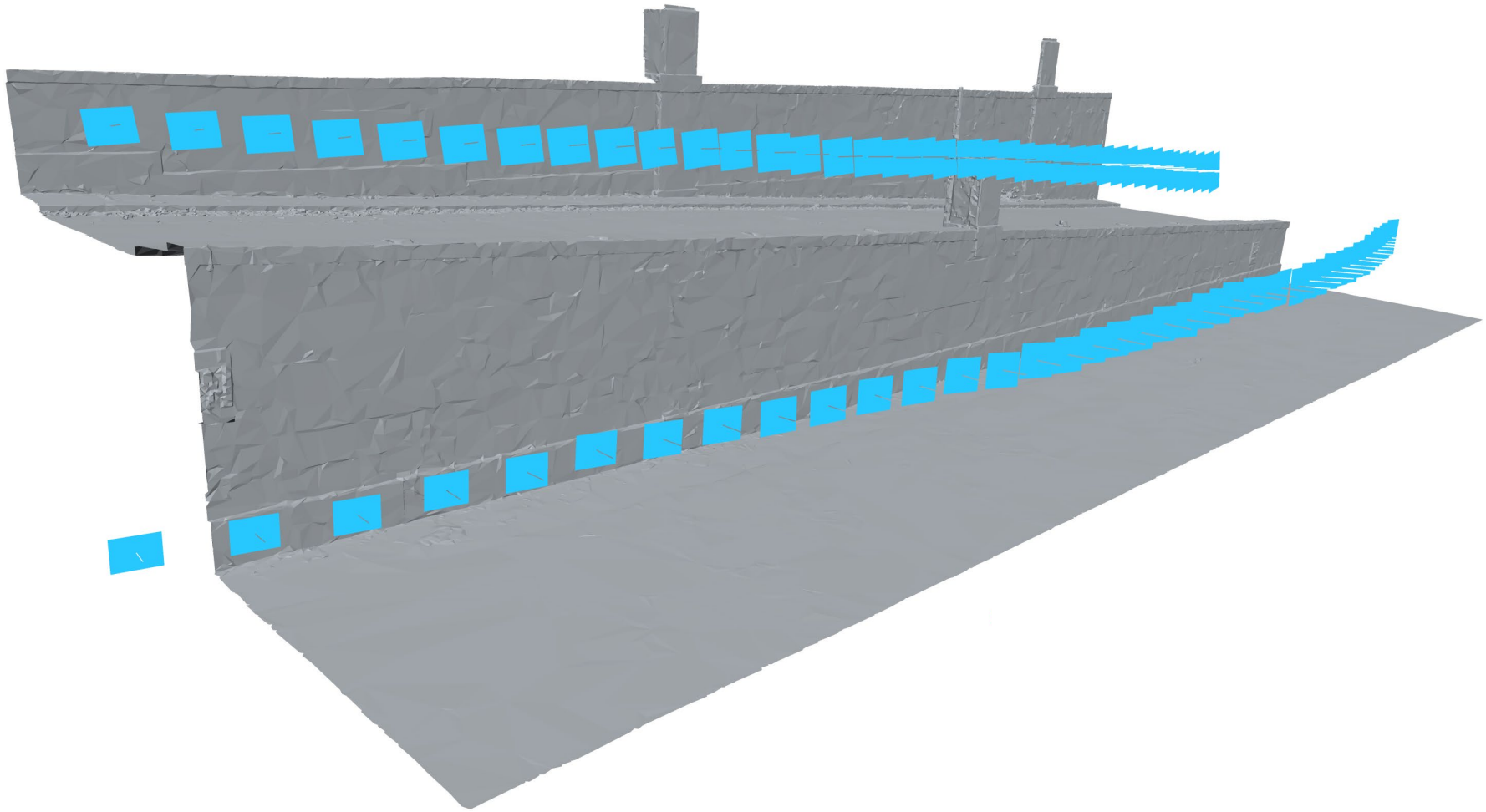


Illustration by Benjamin Wild

IMAGE positioning

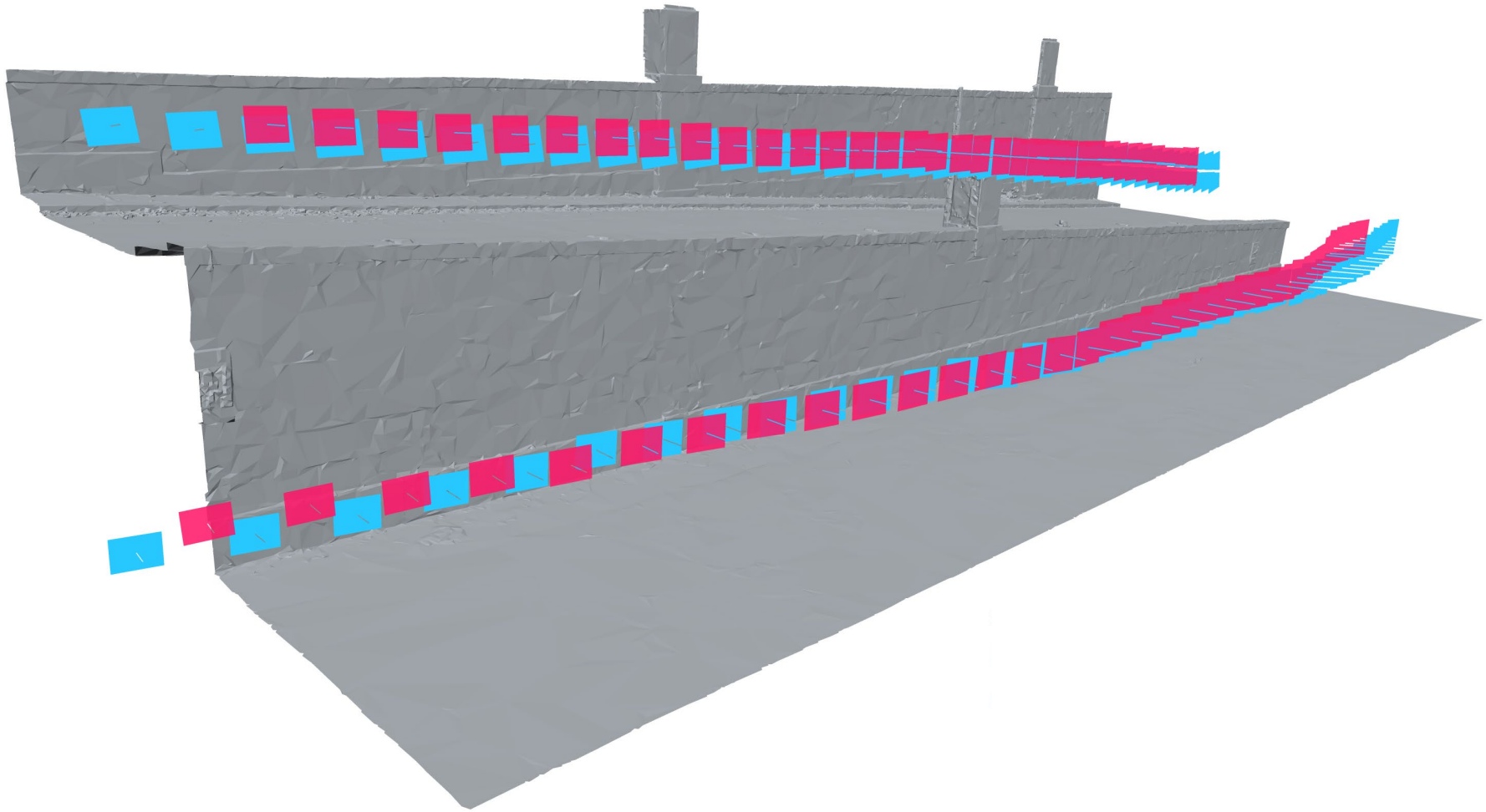
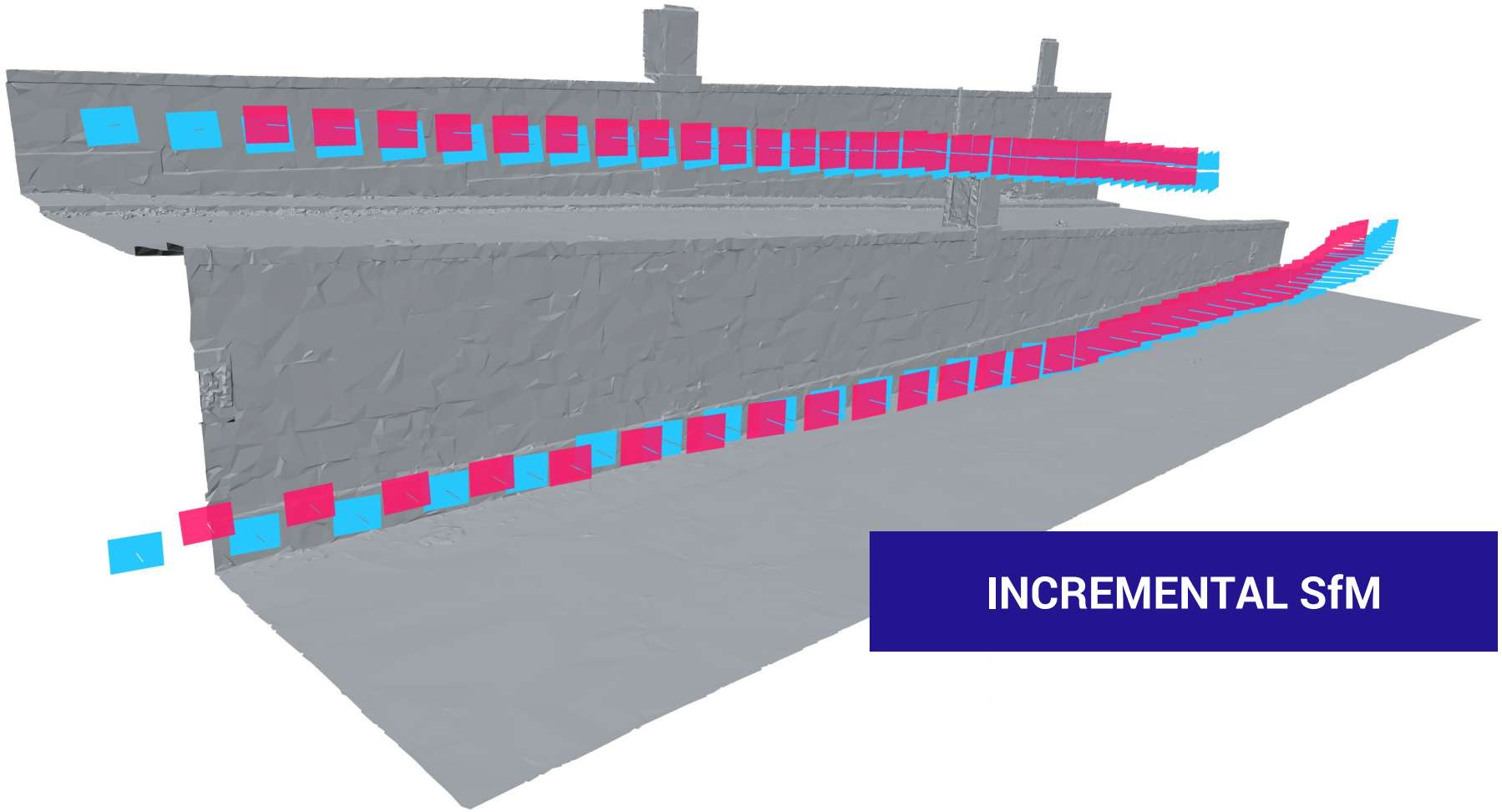


Illustration by Benjamin Wild

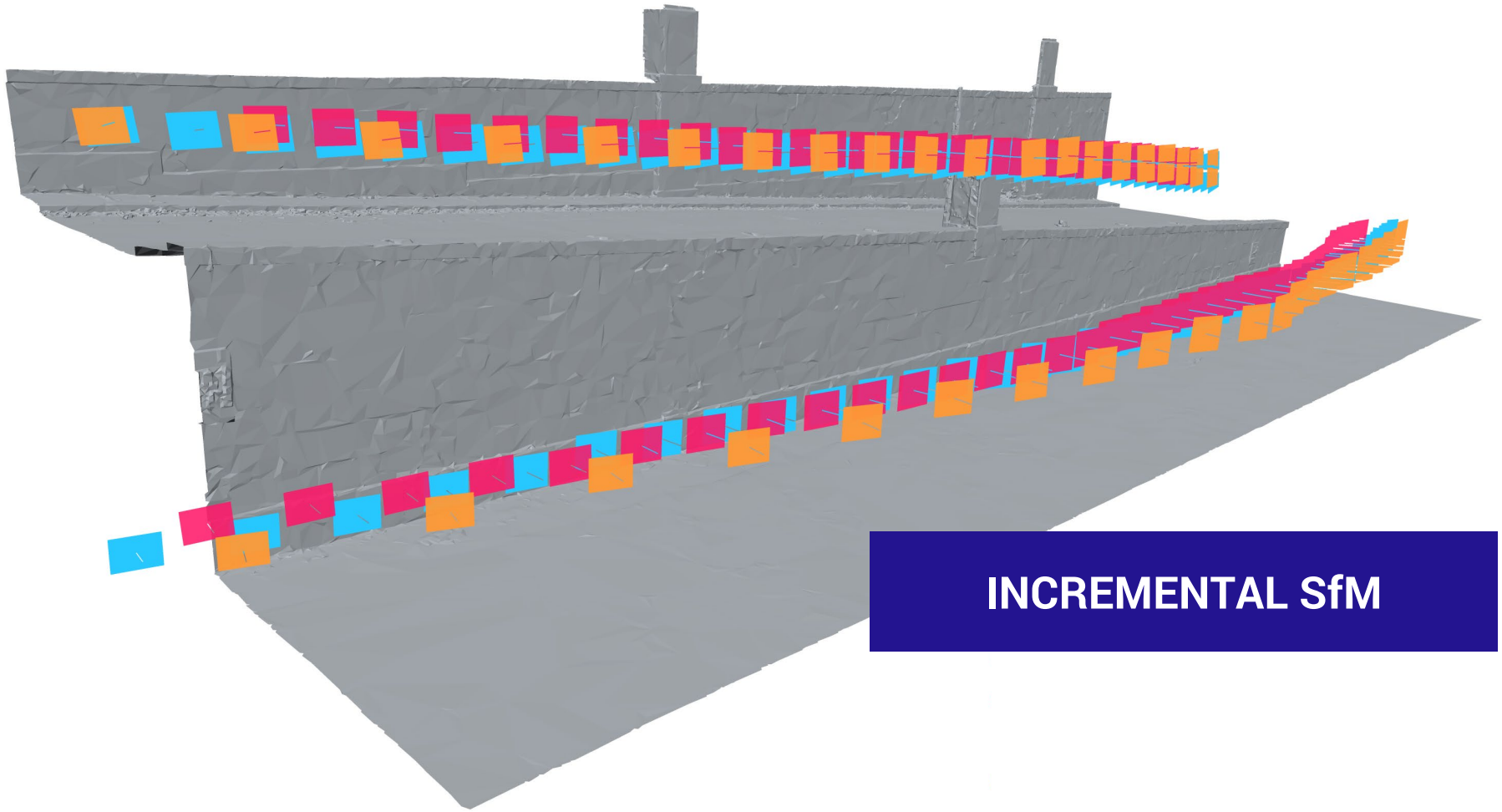
IMAGE positioning



INCREMENTAL SfM

Illustration by Benjamin Wild

IMAGE positioning



INCREMENTAL SfM

Illustration by Benjamin Wild

IMAGE positioning

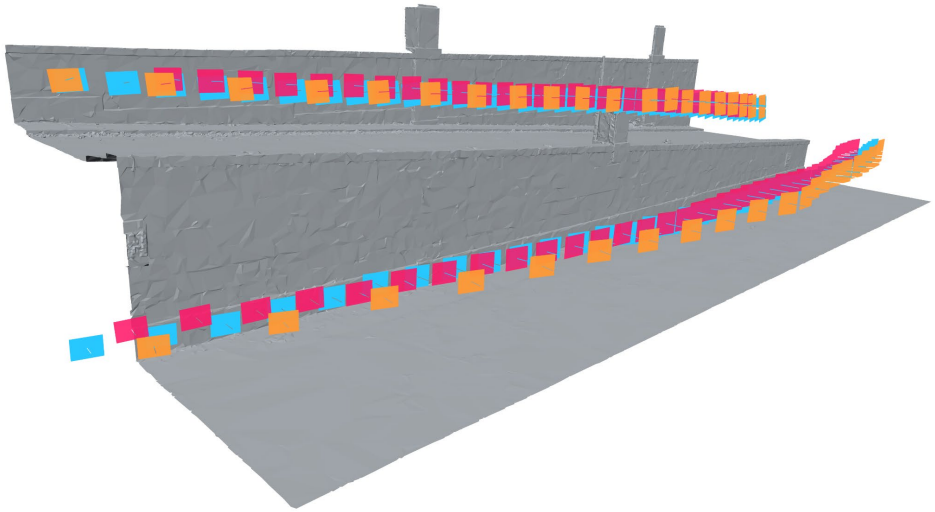
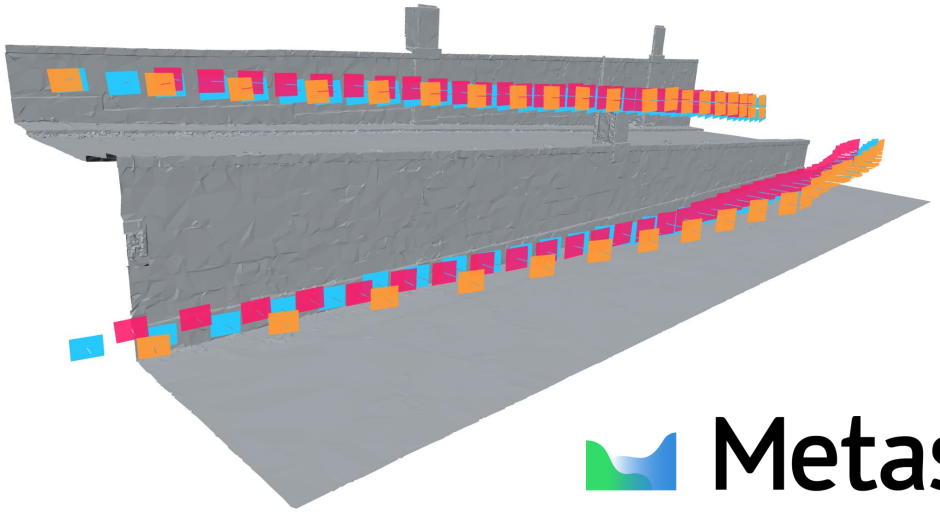


Illustration by Benjamin Wild

IMAGE positioning

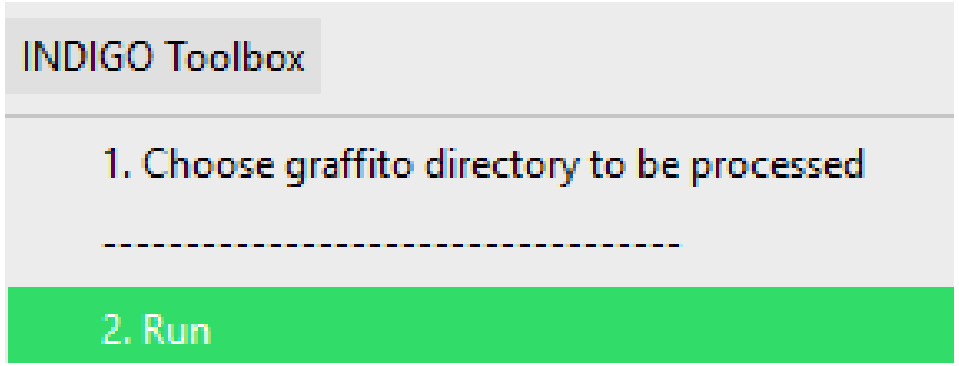


Metashape

Illustration by Benjamin Wild

python™

Metashape



AUTOGRAF

position-accurate pixels

AUTOGRAF

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GraffitiProjectINDIGO / AUTOGRAF Public

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Code Issues Pull requests Actions Projects Security Insights

main 1 branch 0 tags Go to file Code

bewild96 Update README.md 75d27bb 15 days ago 24 commits

Heritage_ClassificationResults	Add files via upload	2 months ago
images	Add files via upload	last month
src	Add files via upload	2 months ago
LICENSE	Initial commit	2 months ago
README.md	Update README.md	15 days ago

README.md

Short Description

AUTOGRAF (**AUT**omated **O**rthorectification of **GRAF**fiti photos) is an open-source python-based Metashape add-on which enables the automated orthorectification of graffiti photos at a specific site of interest. It employs state-of-the art photogrammetric computer vision techniques to allow highly accurate georeferencing and orthorectification of large numbers of photographs. A paper detailing AUTOGRAF's methodology will soon be submitted to Heritage (an MDPI journal).

AUTOGRAF is developed as part of the INDIGO project (In-ventory and DI-sseminate G-raffiti along the d-O-naukanal) carried out by the Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology in close collaboration with the GEO Department of TU Wien University.

How to set up AUTOGRAF

Before AUTOGRAF can be used, the following preparatory steps [1-3] need to be performed:

1 - Install Agisoft's Metashape

About

AUTomatic Orthorectification of GRAFfiti photos

photographs graffiti orthorectification

Readme
GPL-3.0 license
6 stars
1 watching
0 forks

Releases

No releases published

Packages

No packages published

Contributors 2

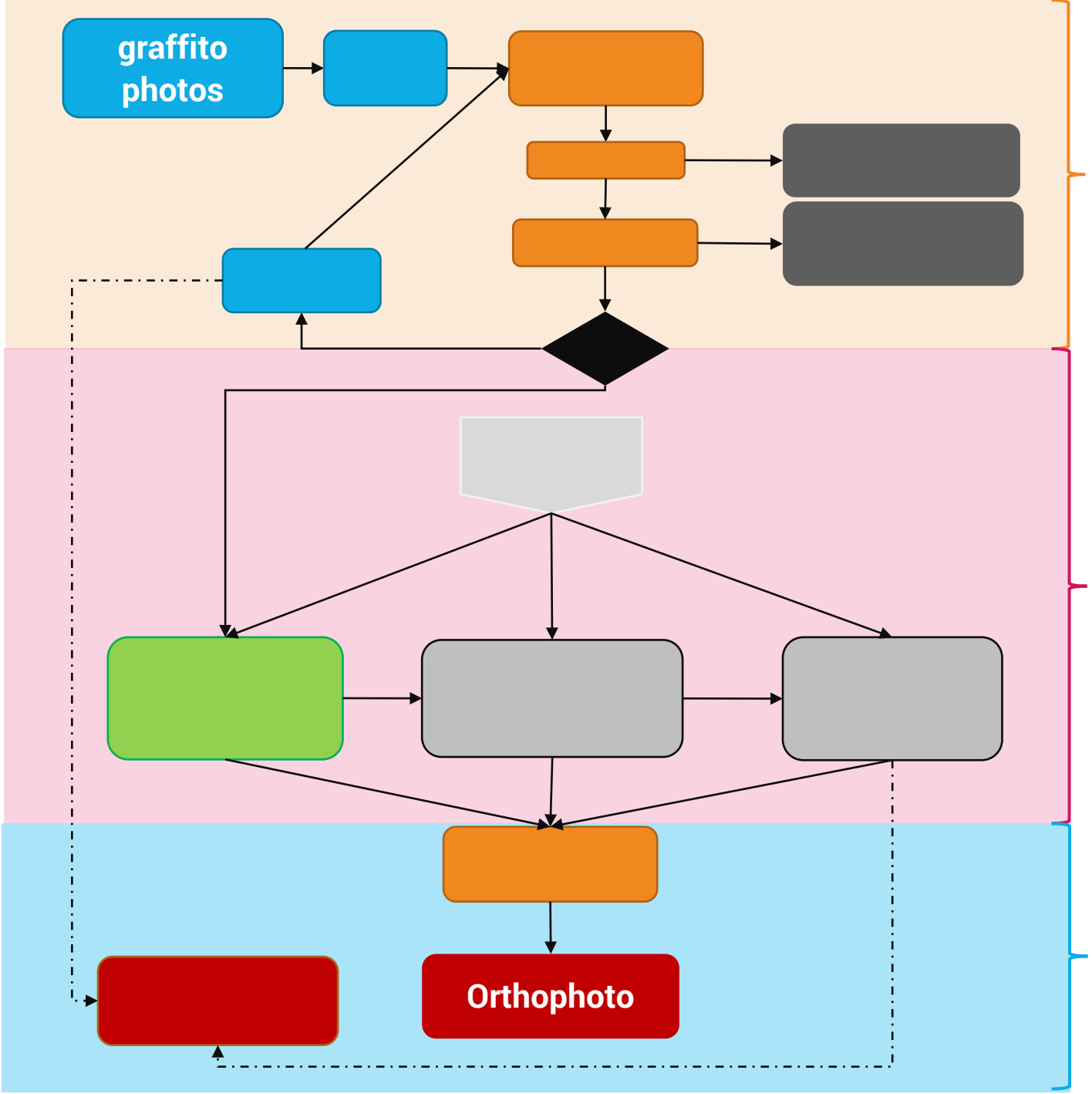
bewild96
BeyondConventionalBoundaries Geert ...

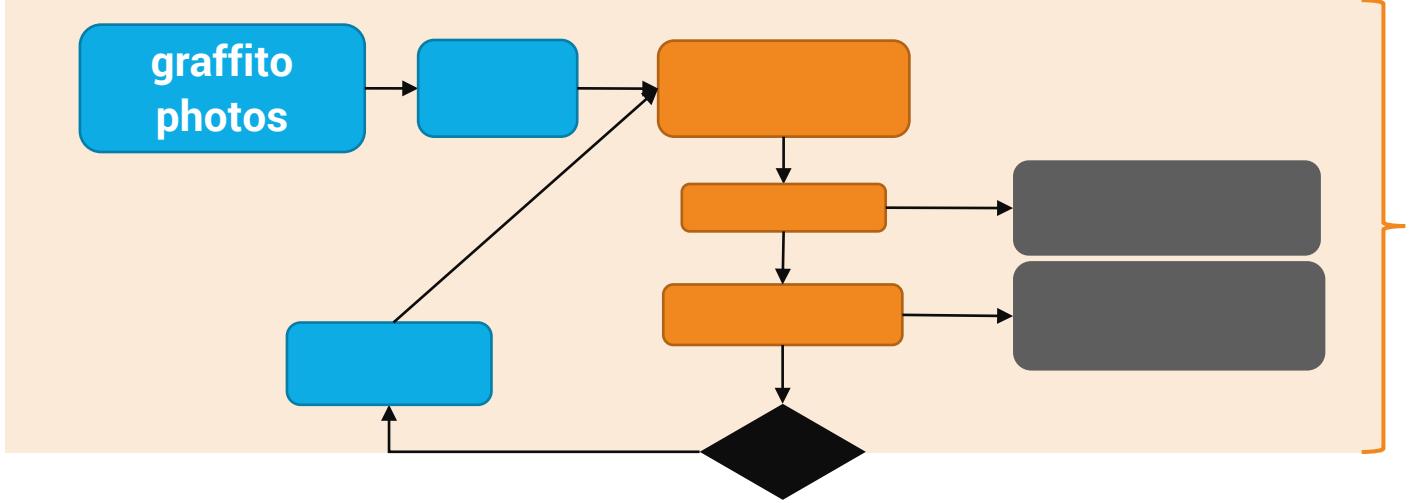
Languages

Python 100.0%

AUTOGRAF

position-accurate pixels


graffito photos
Orthophoto
Initial checks
Camera orientations
Incremental SfM
3D surface model
Orthophoto




INDIGO_2021-12-28_Z7II-B_0292.jpg


INDIGO_2021-12-28_Z7II-B_0293.jpg


INDIGO_2021-12-28_Z7II-B_0294 - Copy.jpg


INDIGO_2021-12-28_Z7II-B_0294.jpg


INDIGO_2021-12-28_Z7II-B_0295.jpg


INDIGO_2021-12-28_Z7II-B_0296.jpg


INDIGO_2021-12-28_Z7II-B_0296a.jpg


INDIGO_2021-12-28_Z7II-B_0297.jpg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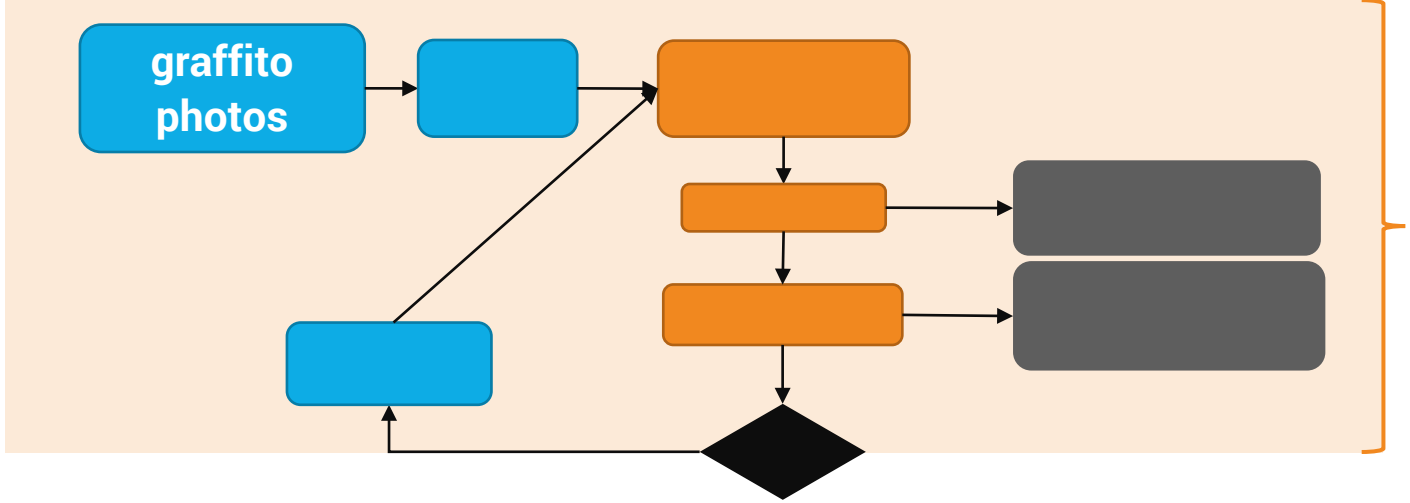

Initial checks


INDIGO_2021-12-28_Z7II-B_0292.jpg


INDIGO_2021-12-28_Z7II-B_0293.jpg


INDIGO_2021-12-28_Z7II-B_0294 - Copy.jpg


INDIGO_2021-12-28_Z7II-B_0294.jpg


INDIGO_2021-12-28_Z7II-B_0295.jpg


INDIGO_2021-12-28_Z7II-B_0296.jpg


INDIGO_2021-12-28_Z7II-B_0296a.jpg


INDIGO_2021-12-28_Z7II-B_0297.jpg


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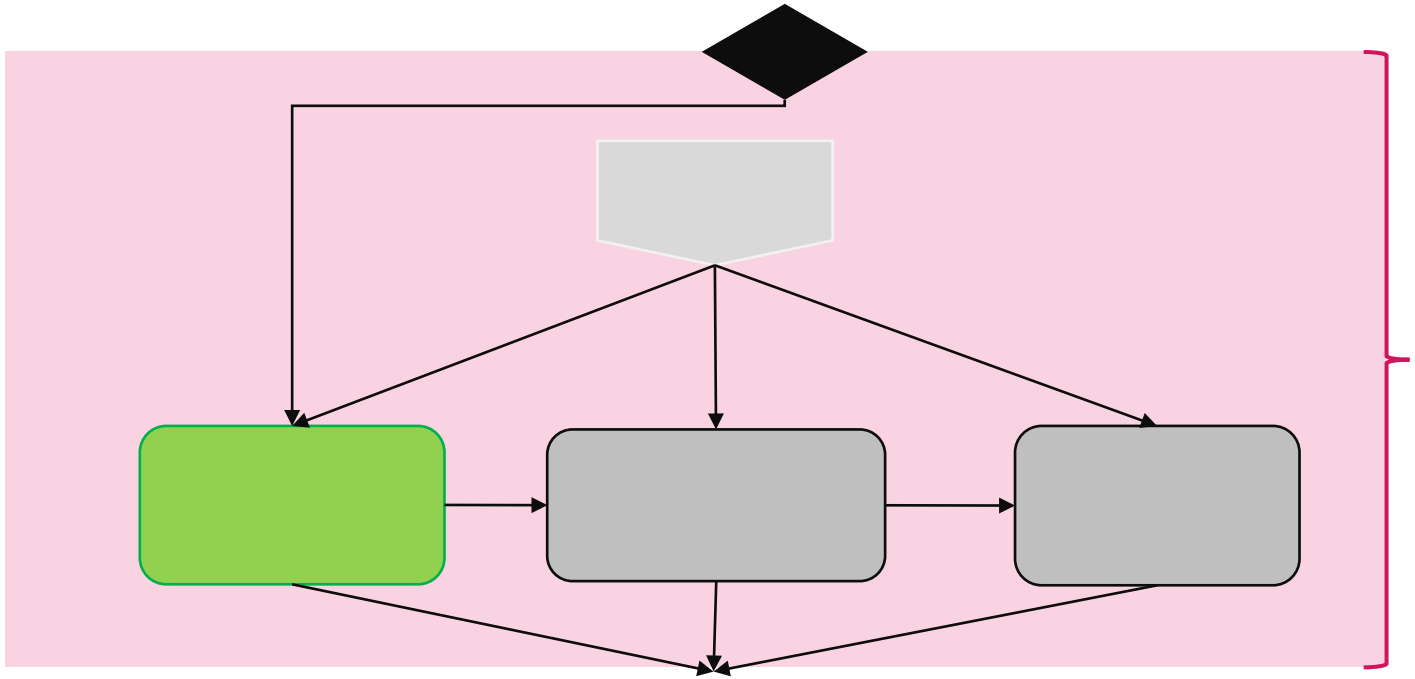
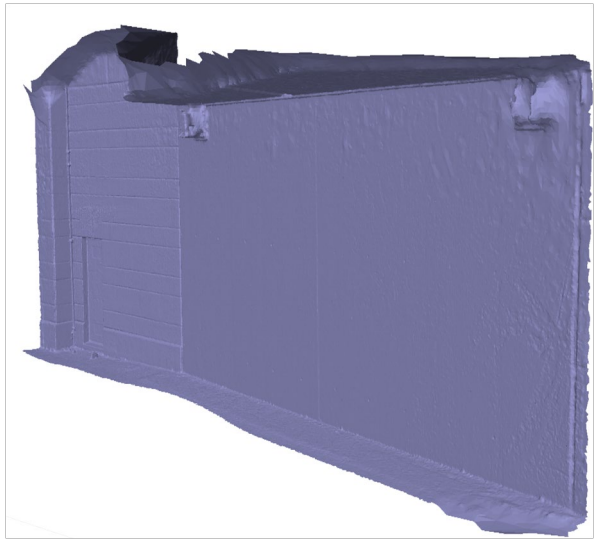
INDIGO_2021-12-28_Z7II-B_0300.jpg



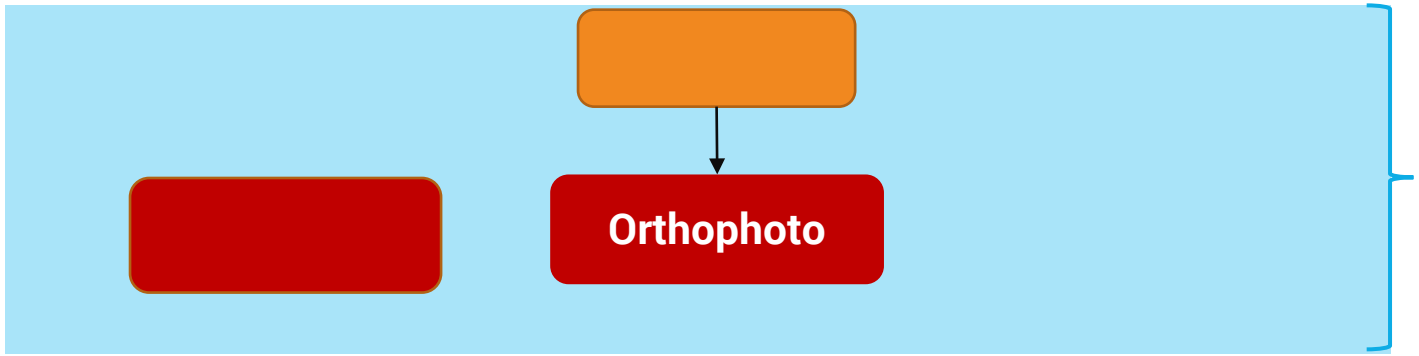
Camera orientations

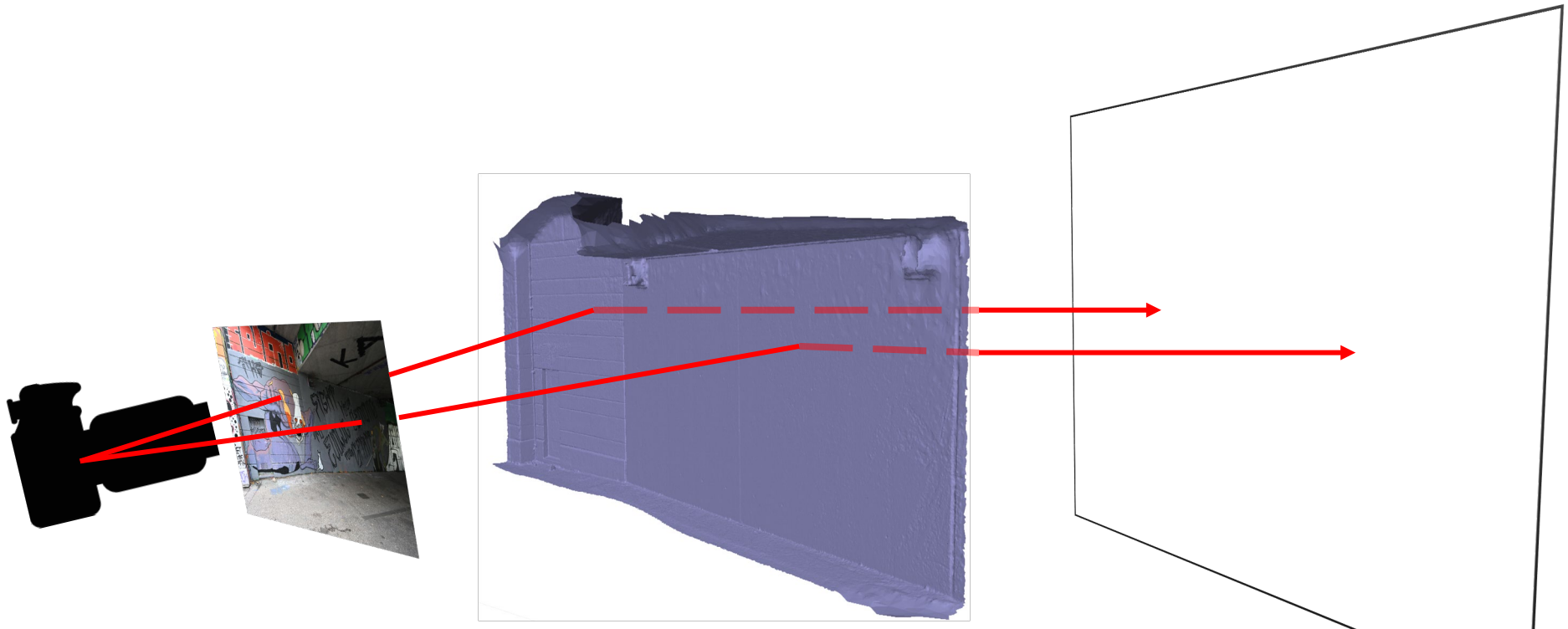
↓

Incremental SfM

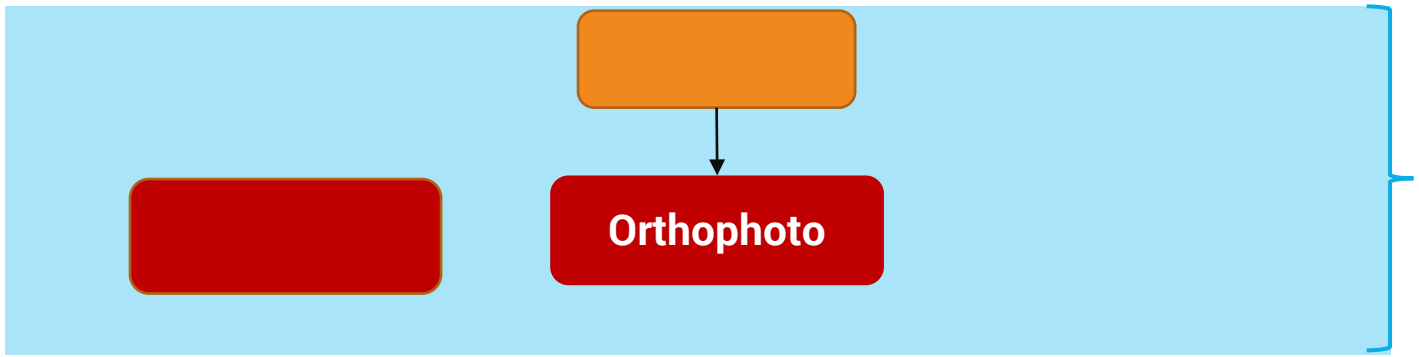


Camera orientations + **3D model**

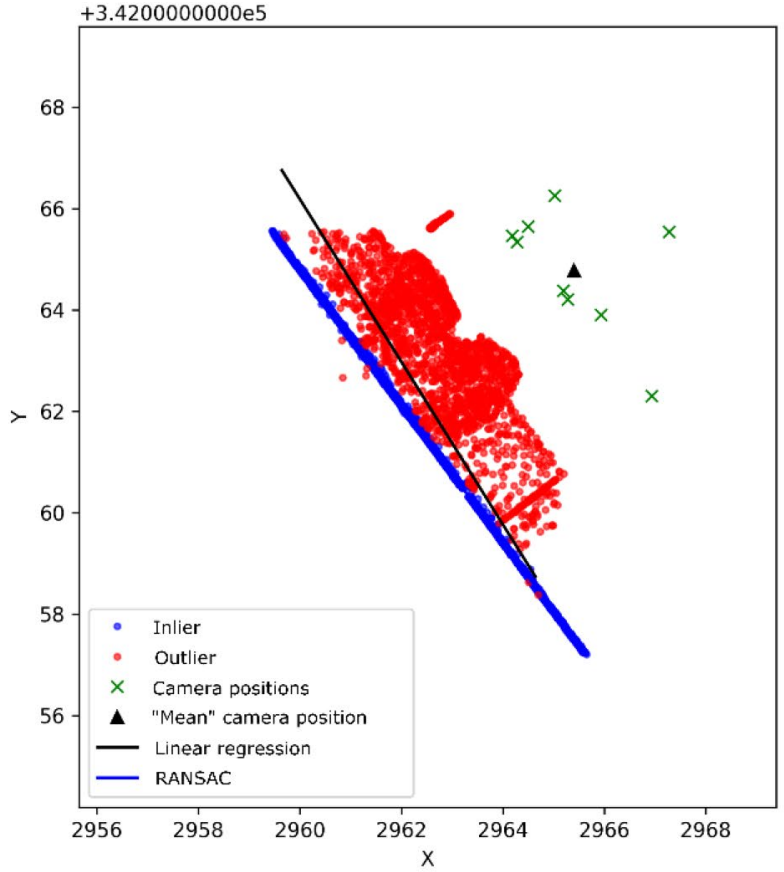


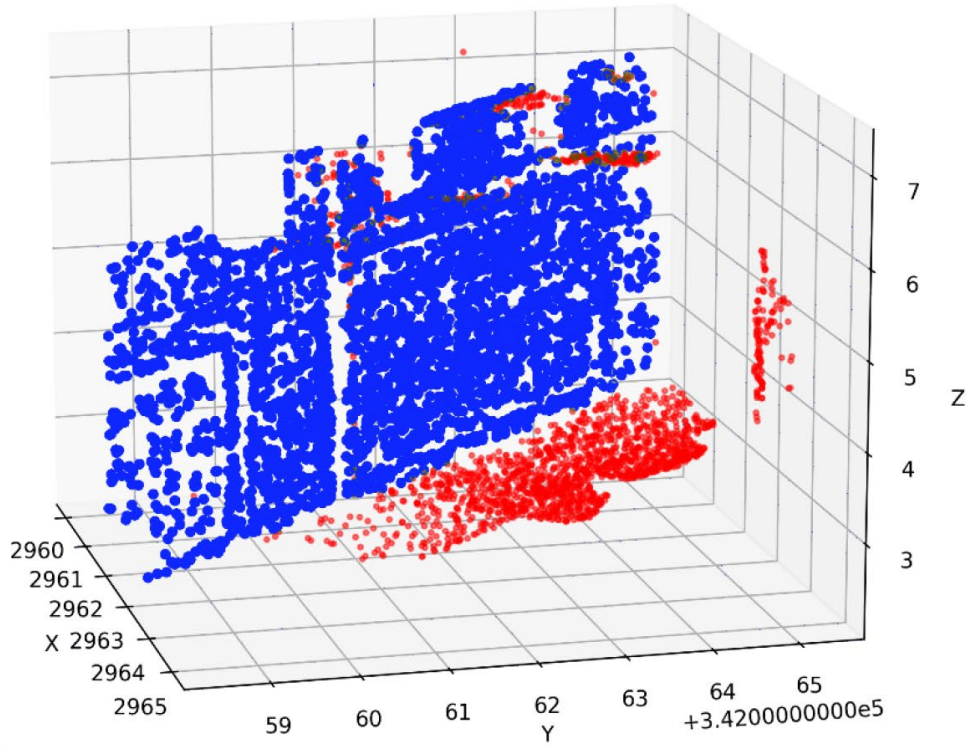


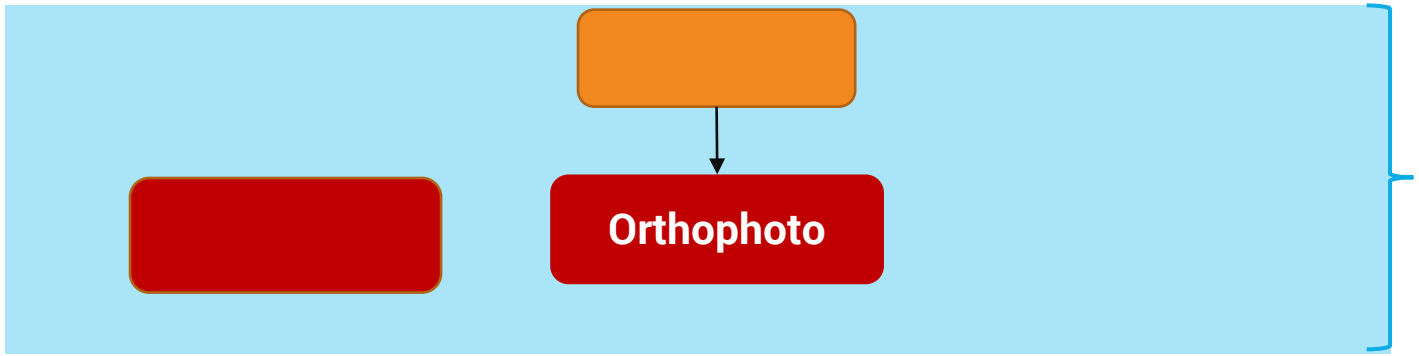
Camera orientations + 3D model + Projection plane



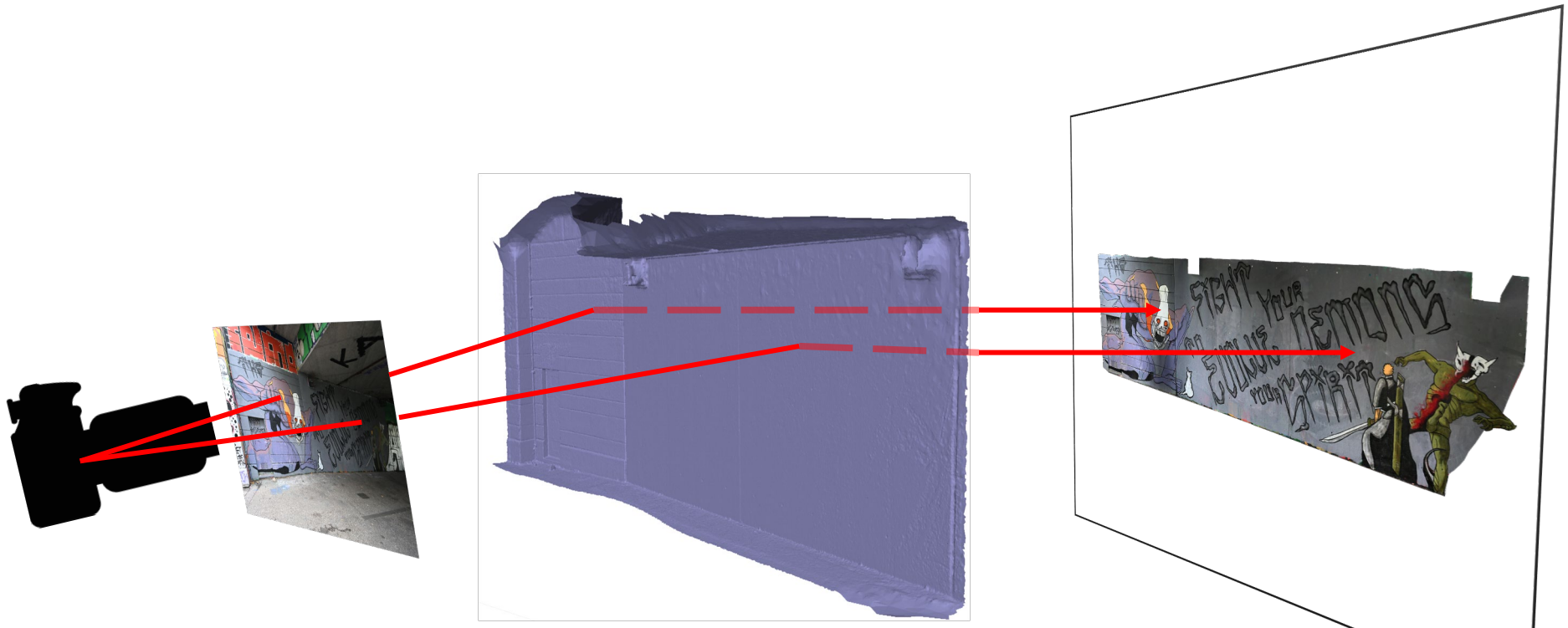
3D surface model
Orthophoto



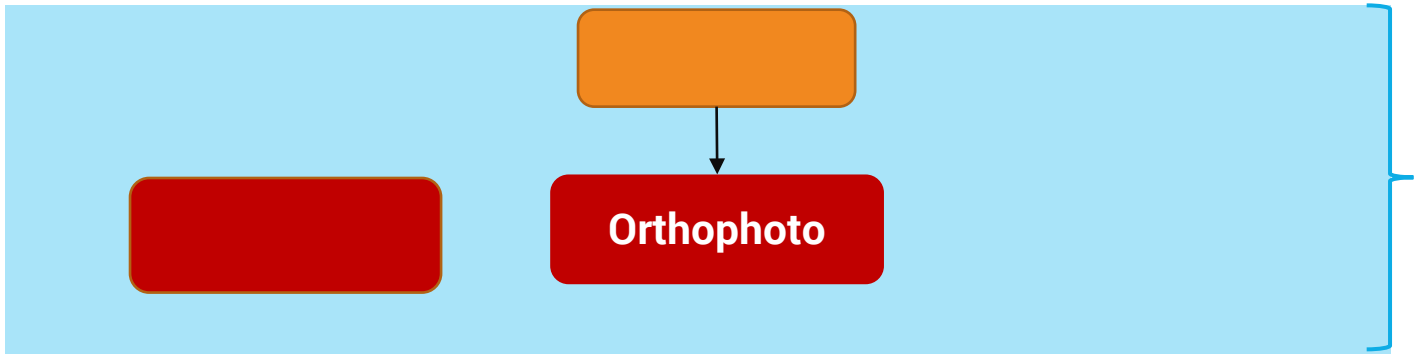




3D surface model
Orthophoto



Camera orientations + 3D model + Projection plane



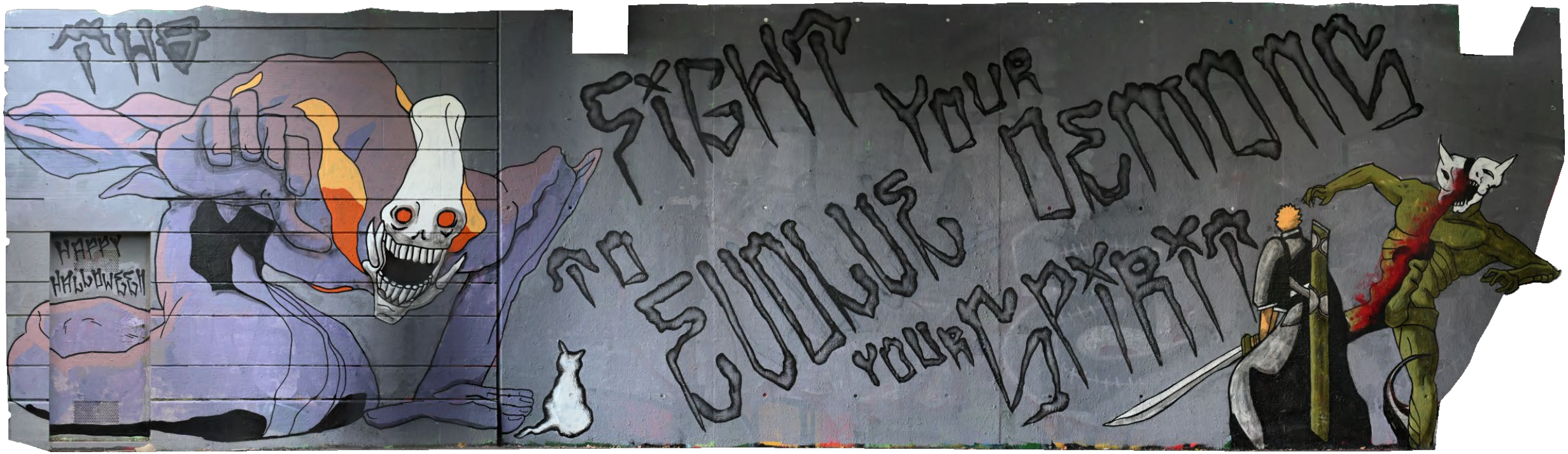
3D surface model
Orthophoto

AUTOGRAF

position-accurate pixels

AUTOGRAF

AUTOGRAF
position-accurate pixels



GRAFFITI monitoring

GRAFFITI monitoring

BASEMAP

ESRI ArcGIS Field Maps

areas with overview photos

cloud-based | tablets

GRAFFITI monitoring

BASEMAP

ESRI ArcGIS Field Maps

areas with overview photos

cloud-based | tablets

MONITOR

check social media

memory

hashtags + form (unused)

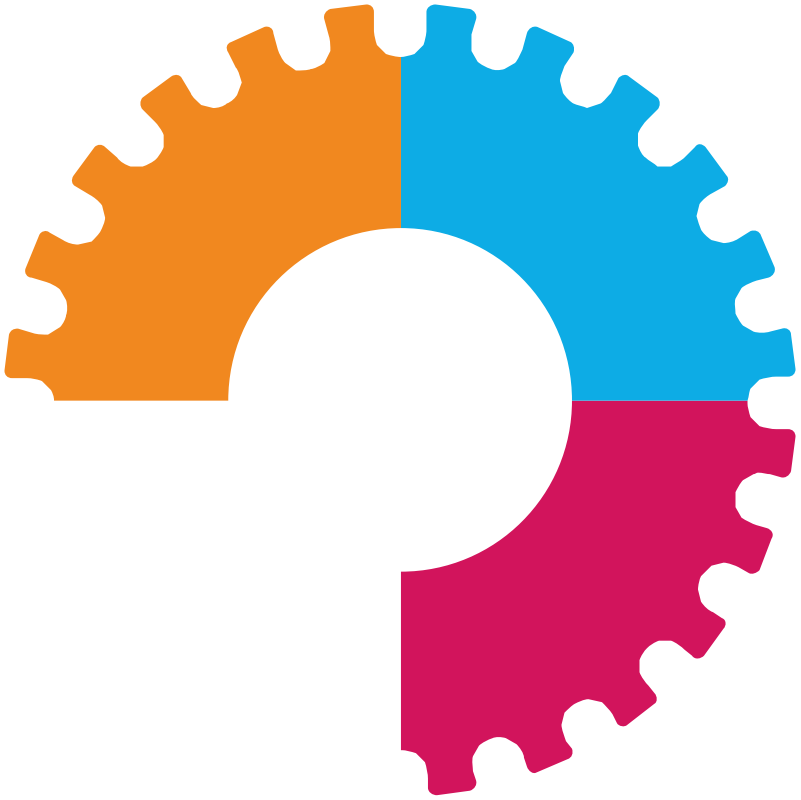
GRAFFITI monitoring

BASEMAP

ESRI ArcGIS Field Maps

areas with overview photos

cloud-based | tablets



MONITOR

check social media

memory

hashtags + form (unused)

ADD TO APP

point: “not photographed”

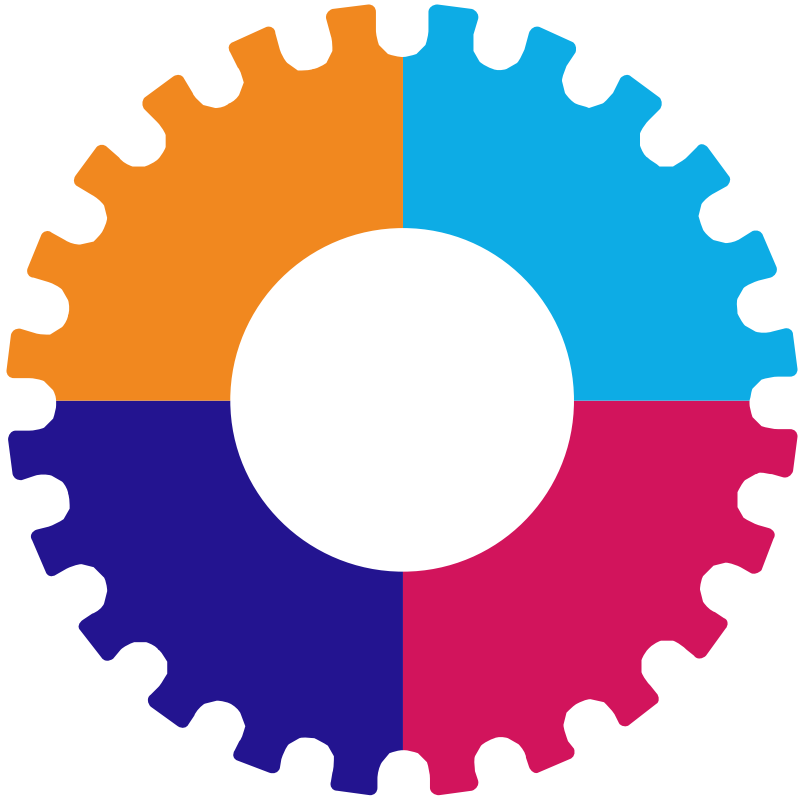
GRAFFITI monitoring

BASEMAP

ESRI ArcGIS Field Maps

areas with overview photos

cloud-based | tablets



MONITOR

check social media

memory

hashtags + form (unused)

DOCUMENT

± 10 photos

spectrometer reading

change status point

new overview photo

ADD TO APP

point: “not photographed”

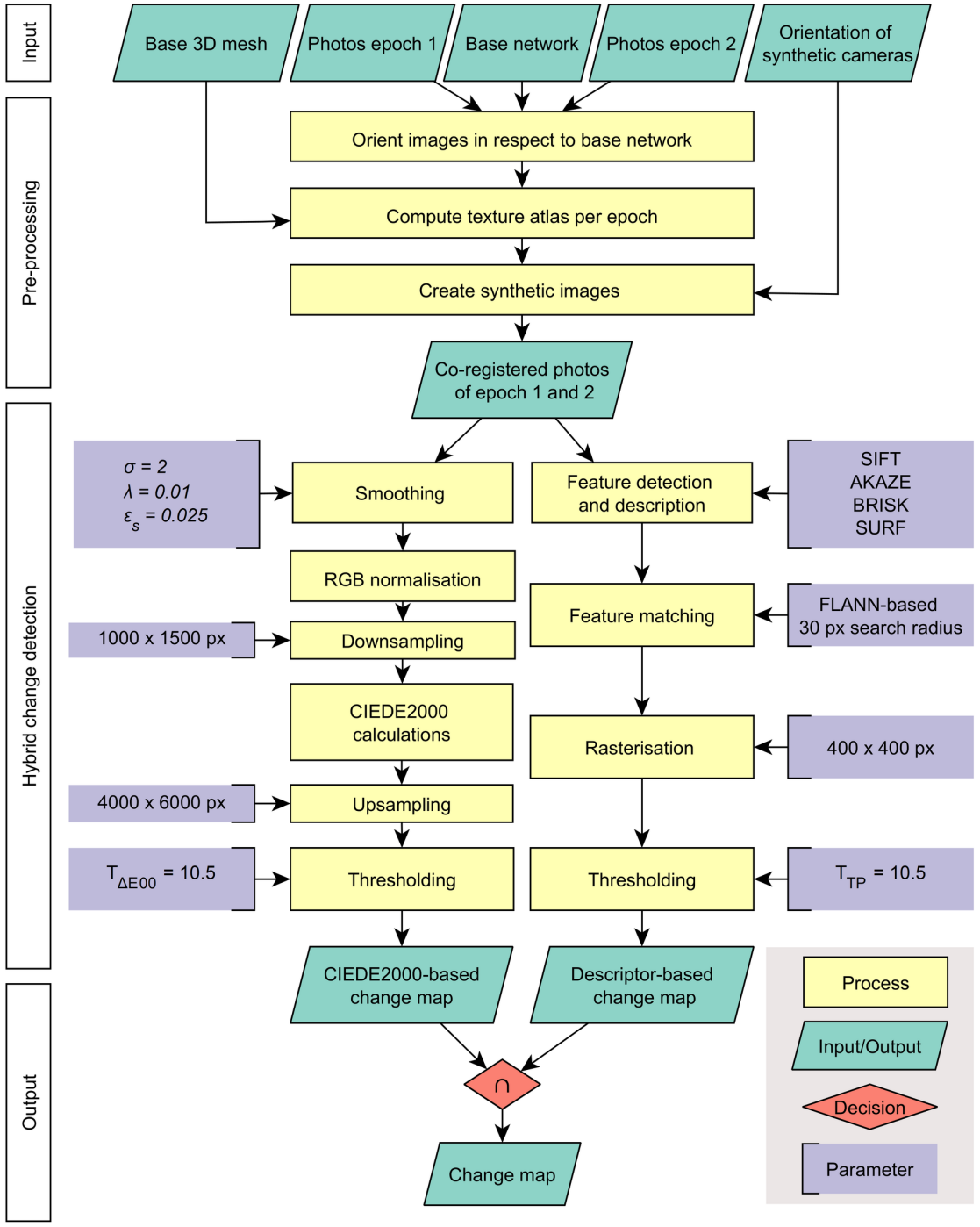
CHANGE
detection

CHANGE
detection

CHANGE
detection

CHANGE
detection

CHANGE detection



CHANGE
detection

CHANGE
detection

CHANGE
detection

CHANGE
detection

CHANGE
detection

CHANGE detection

Published October 11, 2023 | Version 1.0.0

Dataset | Open

INDIGO Change Detection Reference Dataset

Wild, Benjamin[1]; Verhoeven, Geert[2]; Muszyński, Rafał[3]; Pfeifer, Norbert[1]

Show affiliations

Citation Style APA

Wild, B., Verhoeven, G., Muszyński, R., & Pfeifer, N. (2023). INDIGO Change Detection Reference Dataset (1.0.0) [Data set]. TU Wien. https://doi.org/10.48436/ayj4e-v4864

Description

The INDIGO Change Detection Reference Dataset

Description

This graffiti-centred change detection dataset was developed in the context of INDIGO, a research project focusing on the documentation, analysis and dissemination of graffiti along Vienna's Donaukanal. The dataset aims to support the development and assessment of change detection algorithms.

The dataset was collected from a test site approximately 50 meters in length along Vienna's Donaukanal during 11 days between 2022/10/21 and 2022/12/01. Various cameras with different settings were used, resulting in a total of 29 data collection sessions or "epochs" (see "EpochIDs.jpg" for details). Each epoch contains 17 images generated from 29 distinct 3D models with different textures. In total, the dataset comprises 6,902 unique image pairs, along with corresponding reference change maps. Additionally, exclusion masks are provided to ignore parts of the scene that might be irrelevant, such as the background.

COLLECTED photos

COLLECTED photos

TOTAL COVERAGE

2

COLLECTED photos

TOTAL COVERAGE

2

TC PHOTOS

26.7 k

42.0 k

COLLECTED photos

TOTAL COVERAGE

2

FOLLOW-UP

106

TC PHOTOS

26.7 k

42.0 k

COLLECTED photos

TOTAL COVERAGE
2

FOLLOW-UP
106

TC PHOTOS
26.7 k
42.0 k

FU PHOTOS
94.6 k

SOME results

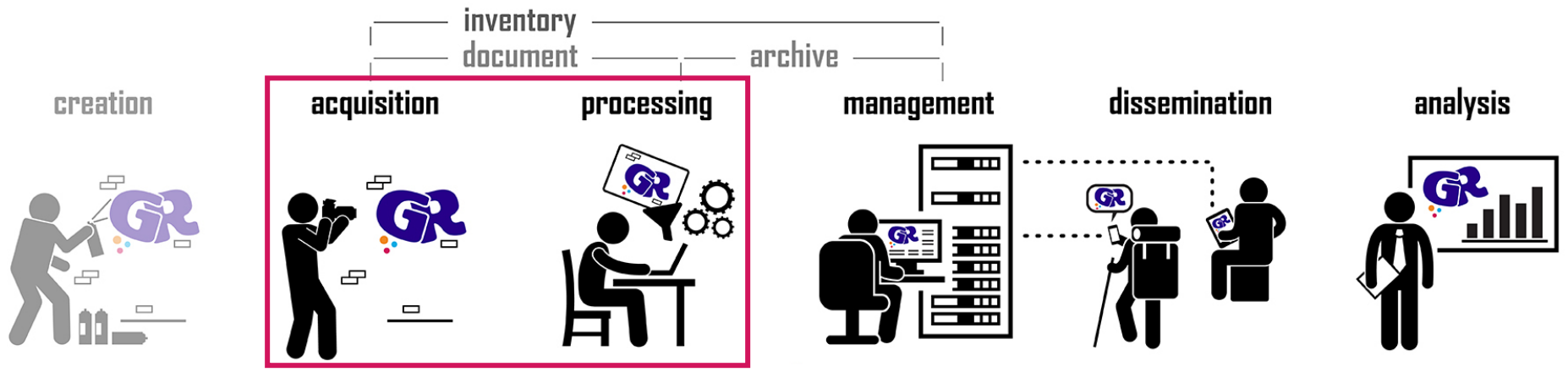
GRAFFITI *LOCATION*

GRAFFITI *TEMPORALITY*

GRAFFITI *TERMINOLOGY*

GRAFFITI *CHARACTERISATION*

5 research pillars



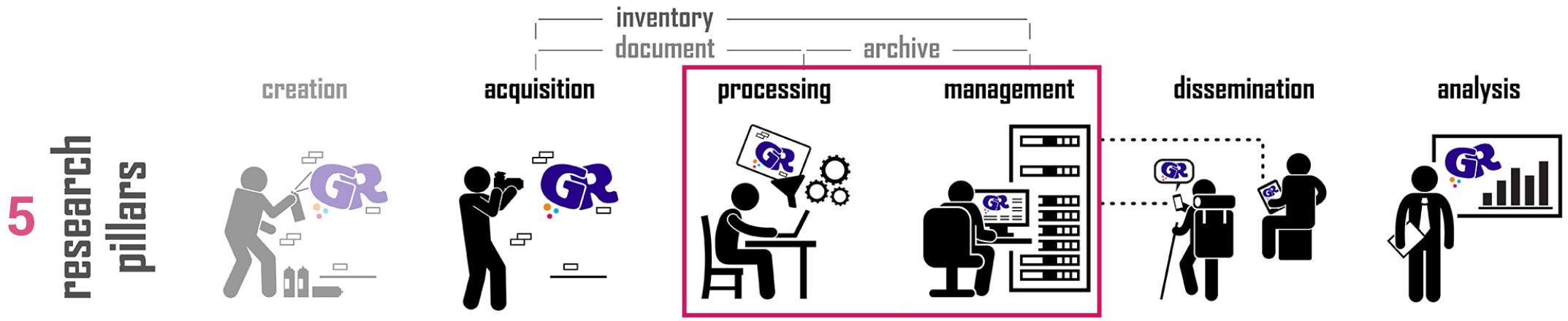
SOME results

GRAFFITI *LOCATION*

GRAFFITI *TEMPORALITY*

GRAFFITI *TERMINOLOGY*

GRAFFITI *CHARACTERISATION*



MOMENTS of creation

16 June 2023 @ 10:25 CET

MOMENTS of creation

16 June 2023 @ 10:25 CET

MOMENTS of creation

16 June 2023 @ 10:25 CET

© Sophie Hay

MOMENTS of creation

date + time

© Sophie Hay

16 June 2023 @ 10:25 CET

date + time

MOMENTS of creation

creation event
date + time

© Sophie Hay

16 June 2023 @ 10:25 CET

date + time
creation event

MOMENTS of creation

photo | ~~graffito~~
creation event
date + time

© Sophie Hay

16 June 2023 @ 10:25 CET

date + time
creation event
photo | ~~graffito~~

MOMENTS of creation

photo | ~~graffito~~
creation event
date + time

© Sophie Hay

16 June 2023 @ 10:25 CET

between 02 & 06 June 2023

date + time
creation event
photo | ~~graffito~~

MOMENTS of creation

photo | ~~graffito~~
creation event
date + time

between AD 41 & AD 79

16 June 2023 @ 10:25 CET

between 02 & 06 June 2023

date + time
creation event
photo | ~~graffito~~

MOMENTS of creation

photo | ~~graffito~~
creation event
date + time

© Sophie Hay

between AD 41 & AD 79

12 days ± 2 days

16 June 2023 @ 10:25 CET

between 02 & 06 June 2023

date + time
creation event
photo | ~~graffito~~

MOMENTS of creation

photo | ~~graffito~~
creation event
date + time

© Sophie Hay

between AD 41 & AD 79

1963 years ± 19 years

16 June 2023 @ 10:25 CET

12 days ± 2 days

between 02 & 06 June 2023

date + time
creation event
photo | ~~graffito~~

MOMENTS of creation

12 days ± 2 days

between 02 & 06 June 2023

~~related to temporal fuzziness~~
photo | ~~graffito~~
creation event
date + time

© Sophie Hay

16 June 2023 @ 10:25 CET

date + time
creation event
photo | ~~graffito~~
~~related to temporal fuzziness~~

between AD 41 & AD 79

1963 years ± 19 years

MOMENTS of creation

extended
temporal uncertainty

~~related to temporal fuzziness~~
photo | ~~graffito~~
creation event
date + time

© Sophie Hay

between AD 41 & AD 79

1963 years ± 19 years

16 June 2023 @ 10:25 CET

12 days ± 2 days

between 02 & 06 June 2023

date + time
creation event
photo | ~~graffito~~
~~related to temporal fuzziness~~

temporal uncertainty
narrow

MOMENTS of creation

visibility (interrupted)
extended
temporal uncertainty

~~related to temporal fuzziness~~
photo | ~~graffito~~
creation event
date + time

© Sophie Hay

between AD 41 & AD 79

1963 years ± 19 years

16 June 2023 @ 10:25 CET

12 days ± 2 days

between 02 & 06 June 2023

date + time
creation event
photo | ~~graffito~~
~~related to temporal fuzziness~~

temporal uncertainty
narrow
visibility

INDIGO METADATA

real graffito
vs
digital derivatives

MOMENTS of creation

visibility (interrupted)
extended
temporal uncertainty

~~related to temporal fuzziness~~
photo | ~~graffito~~
creation event
date + time

© Sophie Hay

between AD 41 & AD 79

1963 years ± 19 years

16 June 2023 @ 10:25 CET

12 days ± 2 days

between 02 & 06 June 2023

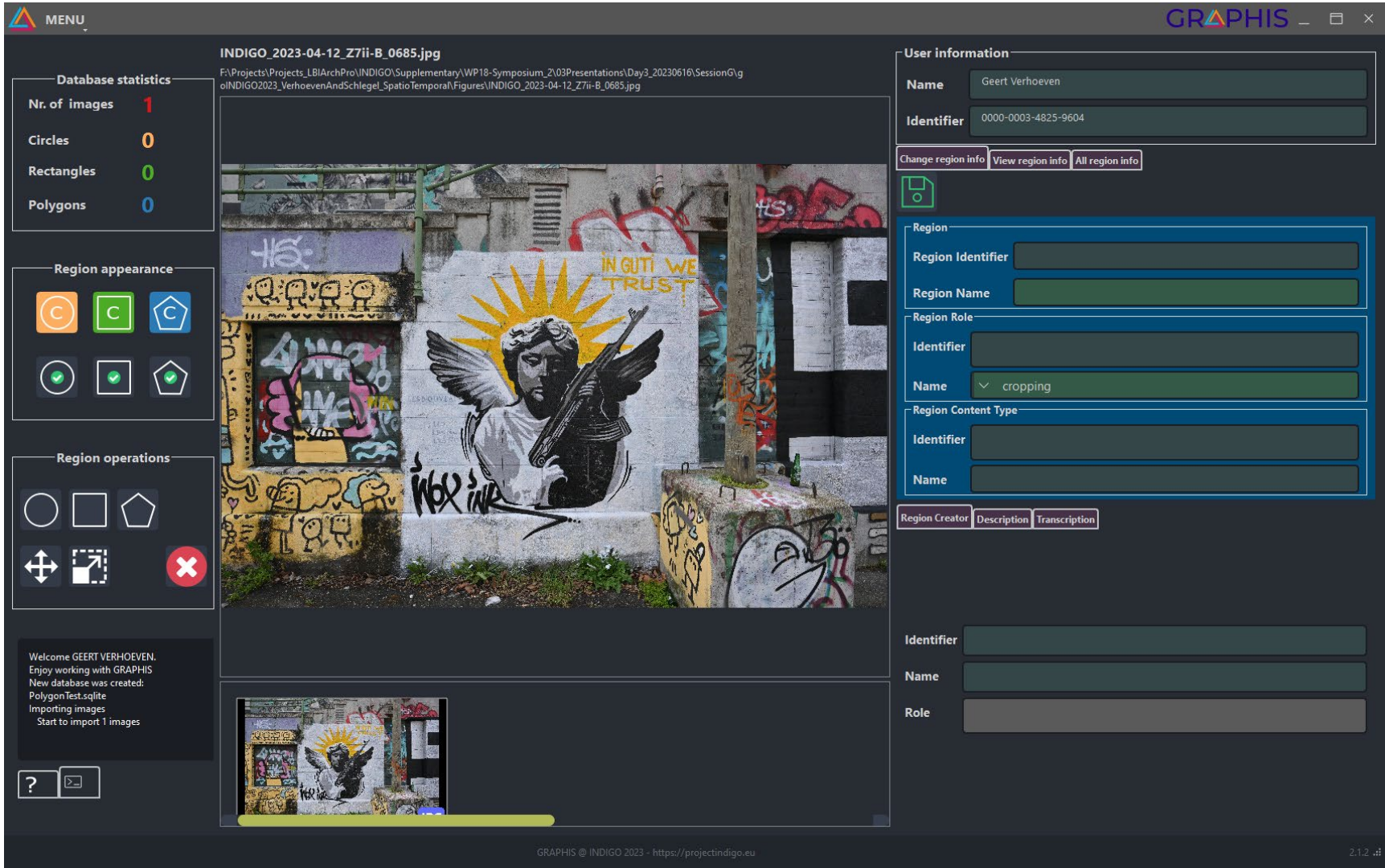
date + time
creation event
photo | ~~graffito~~
~~related to temporal fuzziness~~

temporal uncertainty
narrow
visibility

CREATING location

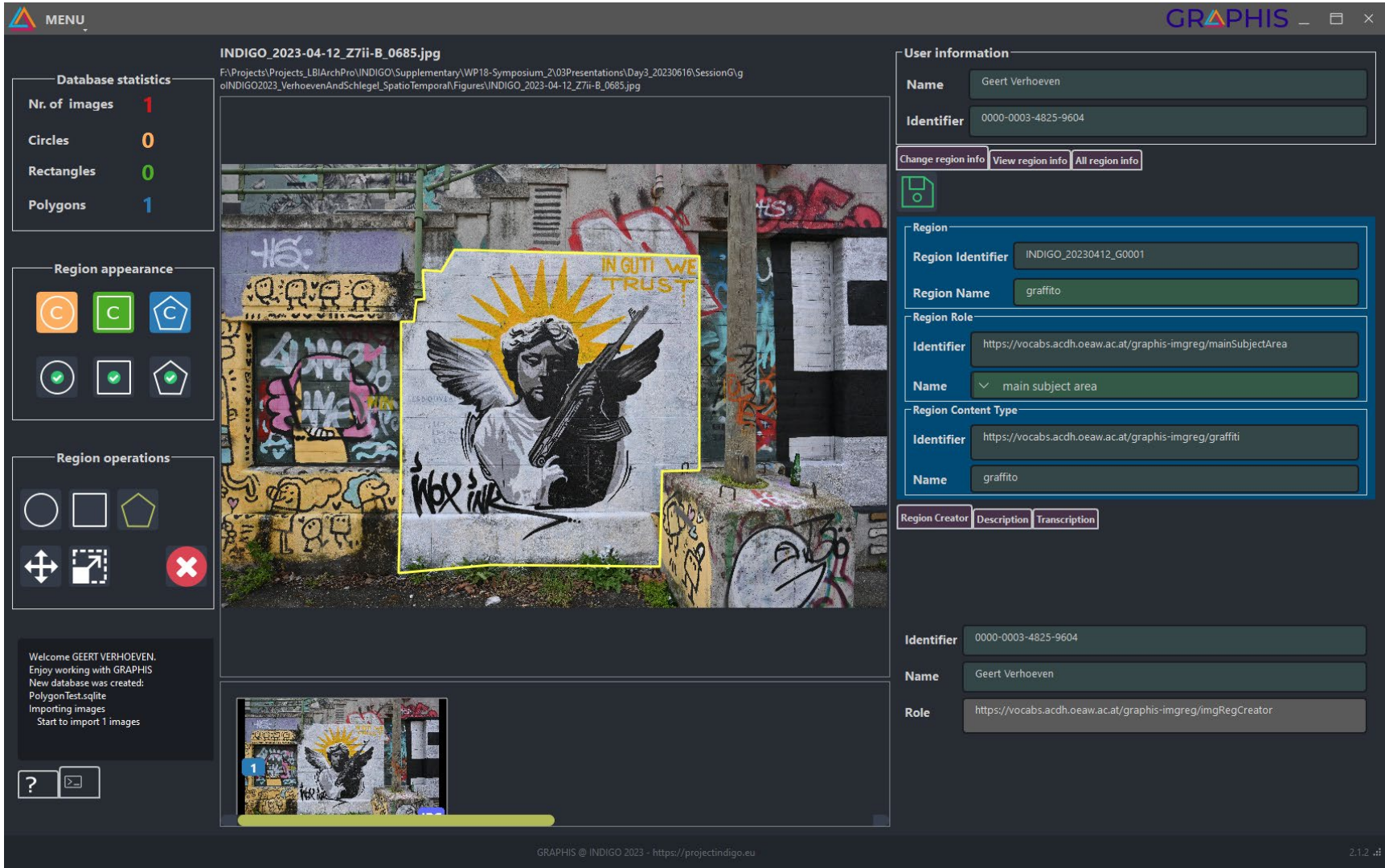
CREATING location

GRAPHIS



CREATING location

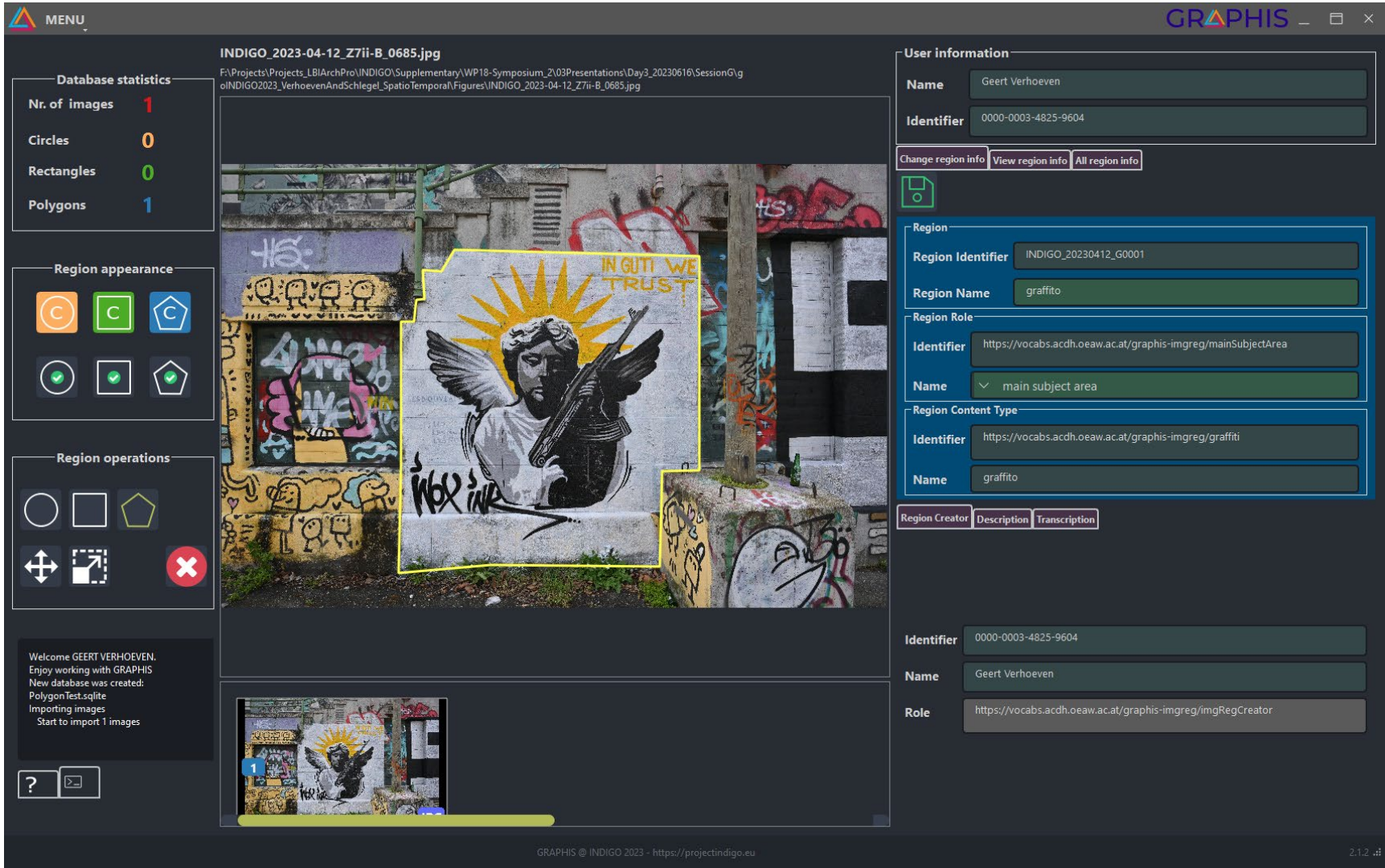
GRAPHIS



CREATING location

GRAPHIS

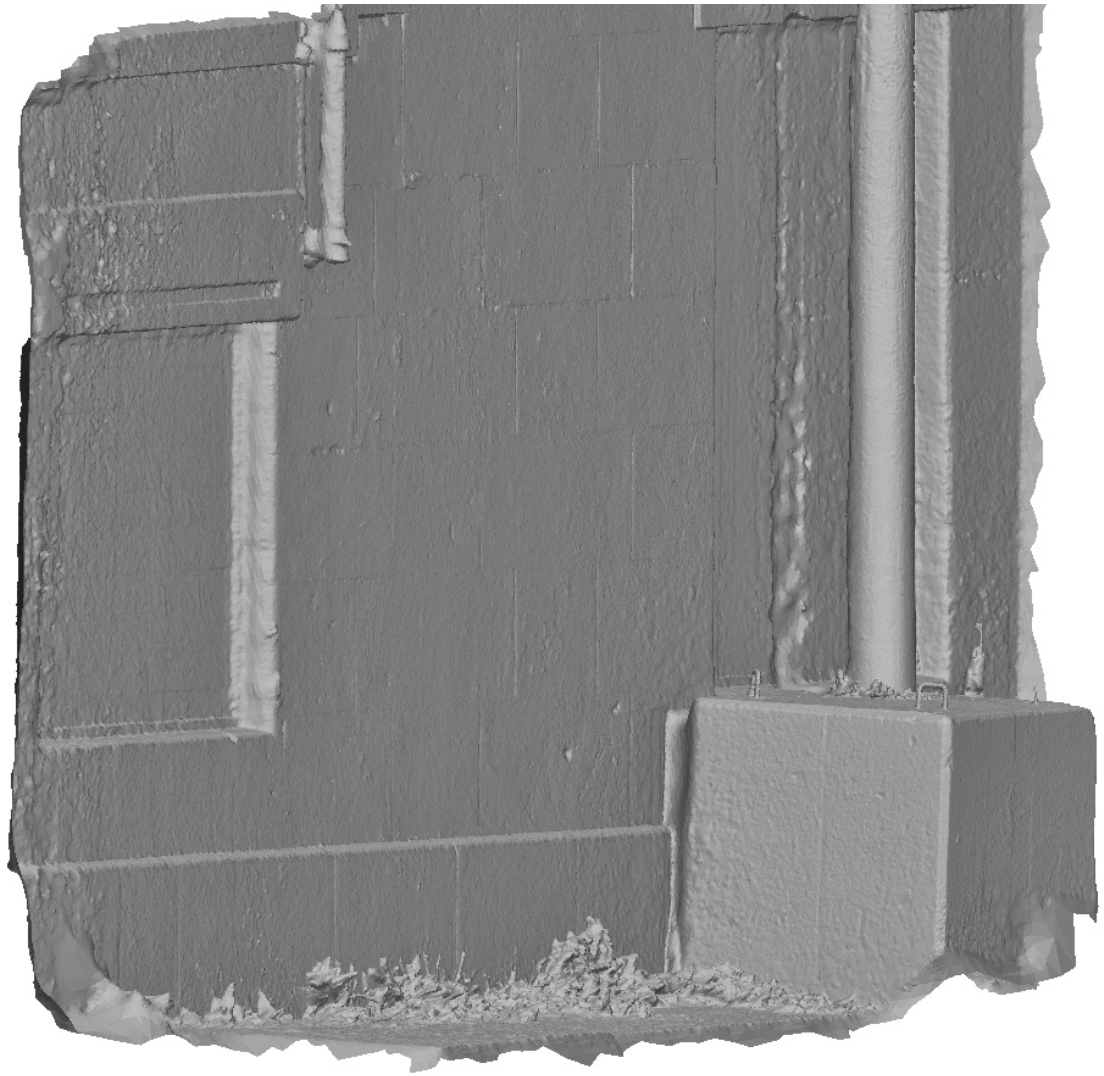
2D polygon (pixel coordinates)



CREATING location

GRAPHIS

2D polygon (pixel coordinates)



AUTOGRAF

CREATING location

GRAPHIS

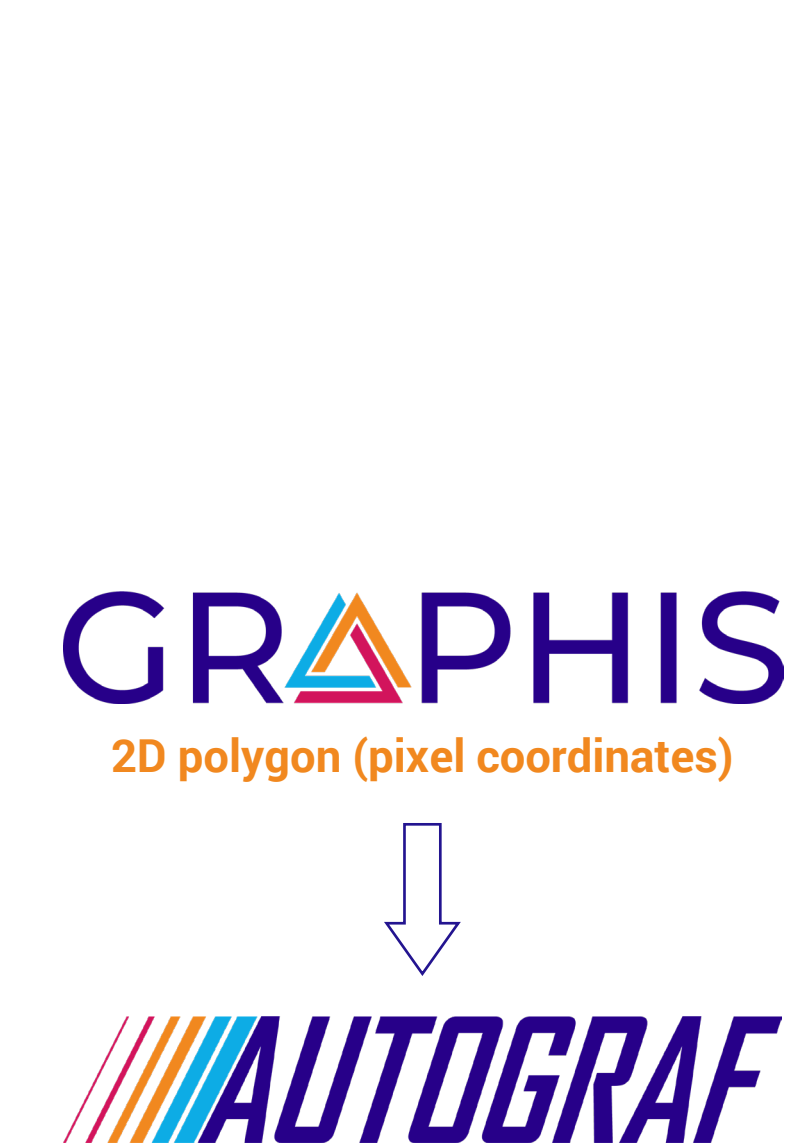
2D polygon (pixel coordinates)

AUTOGRAF

CREATING location

GRAPHIS

2D polygon (pixel coordinates)



AUTOGRAF

CREATING location

GRAPHIS

2D polygon (pixel coordinates)

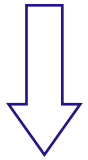
AUTOGRAF

3D polyline (real-world coordinates)

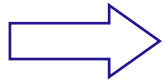
CREATING location

GRAPHIS

2D polygon (pixel coordinates)



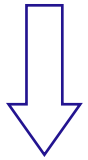
AUTOGRAF

3D polyline (real-world coordinates)  2D polygon (pseudo real-world coordinates)

CREATING location

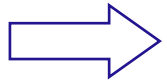
GRAPHIS

2D polygon (pixel coordinates)



AUTOGRAF

3D polyline (real-world coordinates)



2D polygon (pseudo real-world coordinates)

?

STORING location

GRAPHIS

2D polygon (pixel coordinates)

AUTOGRAF

3D polyline (real-world coordinates)

STORING location

XMP metadata

GRAPHIS

2D polygon (pixel coordinates)

AUTOGRAF

3D polyline (real-world coordinates)

STORING location

XMP metadata

GRAPHIS

2D polygon (pixel coordinates)

GeoJSON

AUTOGRAF

3D polyline (real-world coordinates)

STORING location

XMP metadata

GRAPHIS

2D polygon (pixel coordinates)

GeoJSON

AUTOGRAF

3D polyline (real-world coordinates)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    "properties": {
    },
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      "coordinates": [
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```

STORING time

XMP metadata

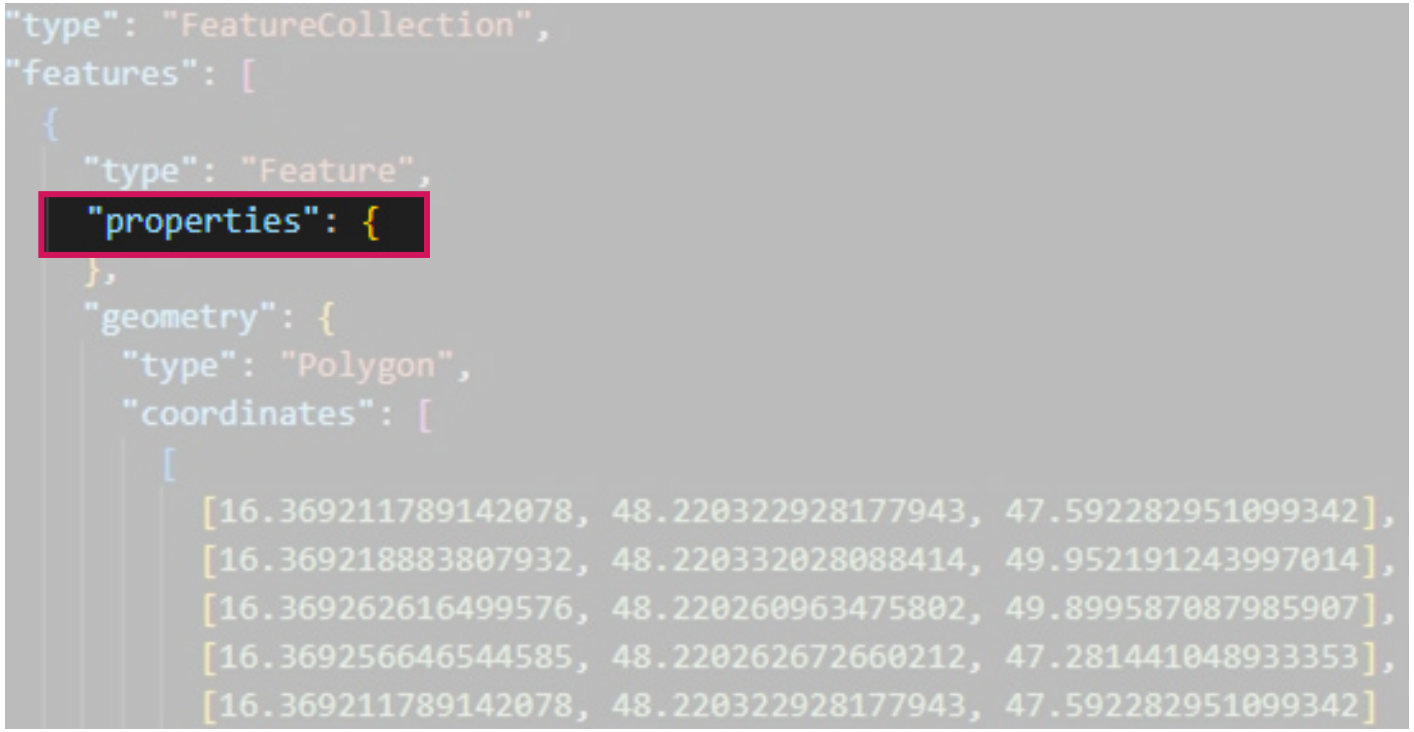
GRAPHIS

2D polygon (pixel coordinates)

GeoJSON

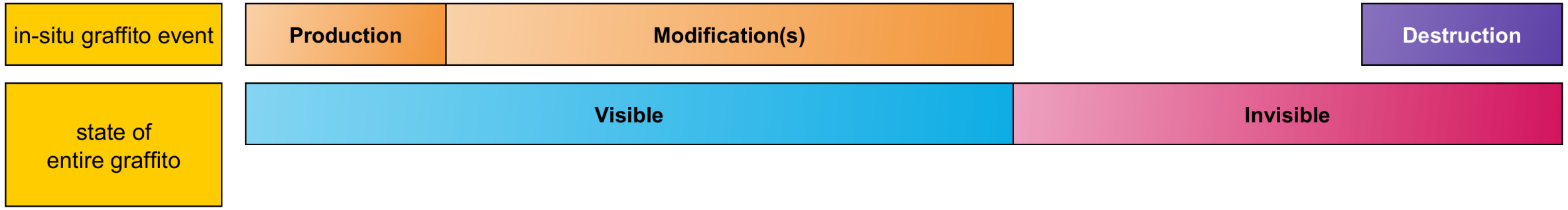
AUTOGRAF

3D polyline (real-world coordinates)

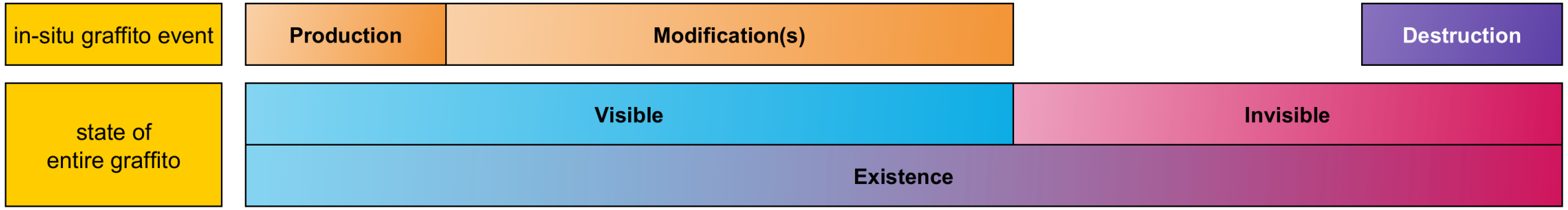


STORING time

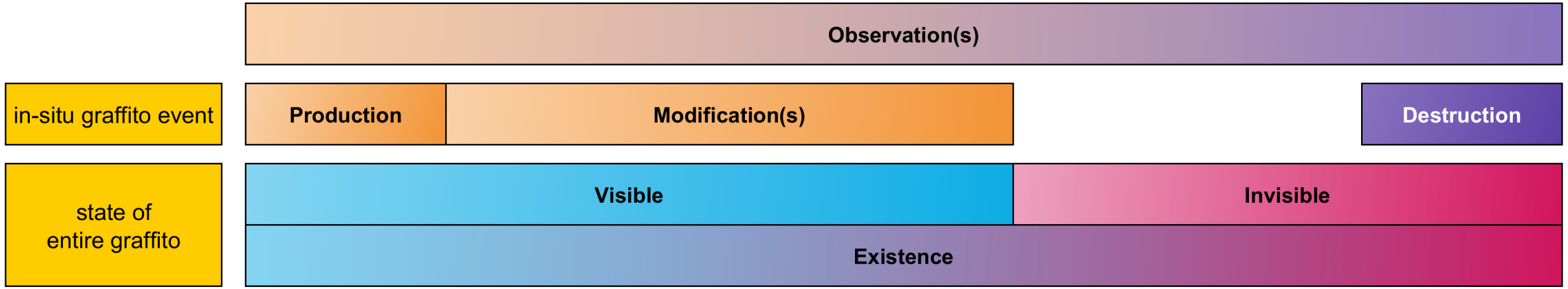
STORING time



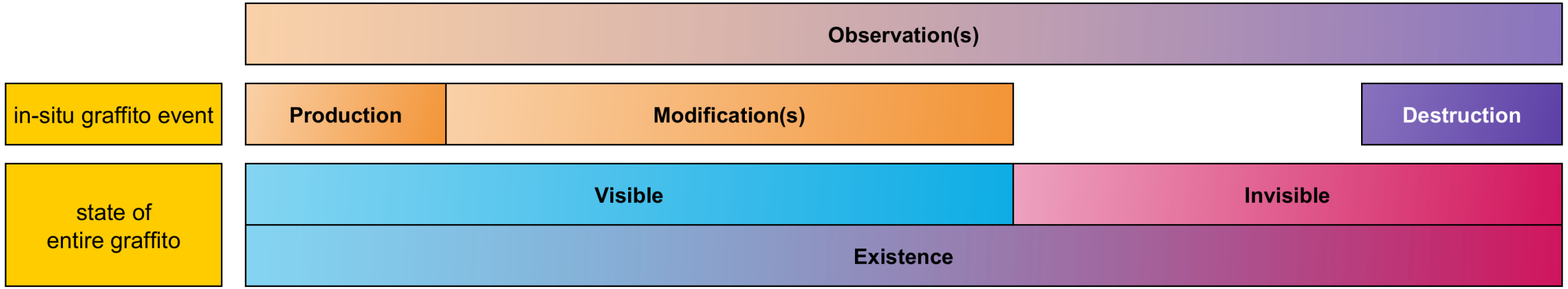
STORING time



STORING time



STORING time

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  "polygon_state": "initial or derived",
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  "production": {···
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```

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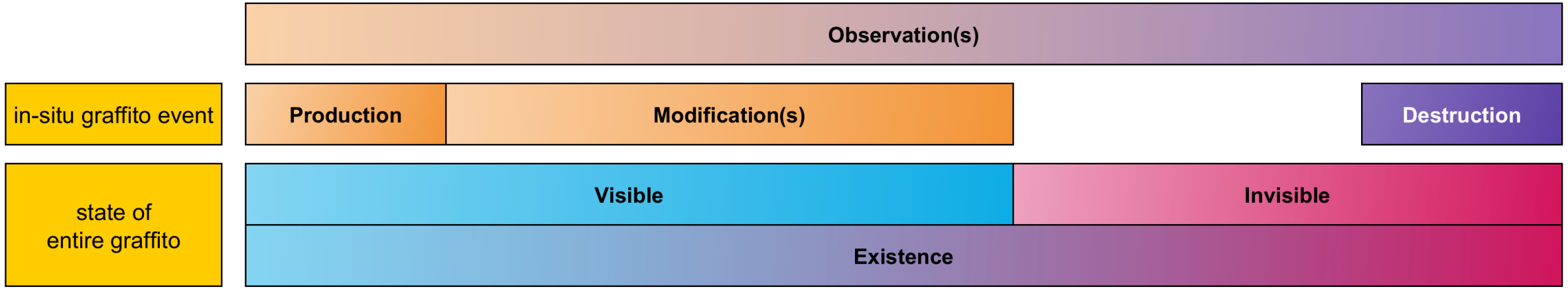
  },

  "existence": {···
  }
```

STORING time




```
"type": "Feature",
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  "polygon_creation": "manual, semi-automatic or automatic",
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  "observation": {···
  },

  "production": {···
  },
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```
  "modification": [···
  ],

  "destruction": {···
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  "visible": {···
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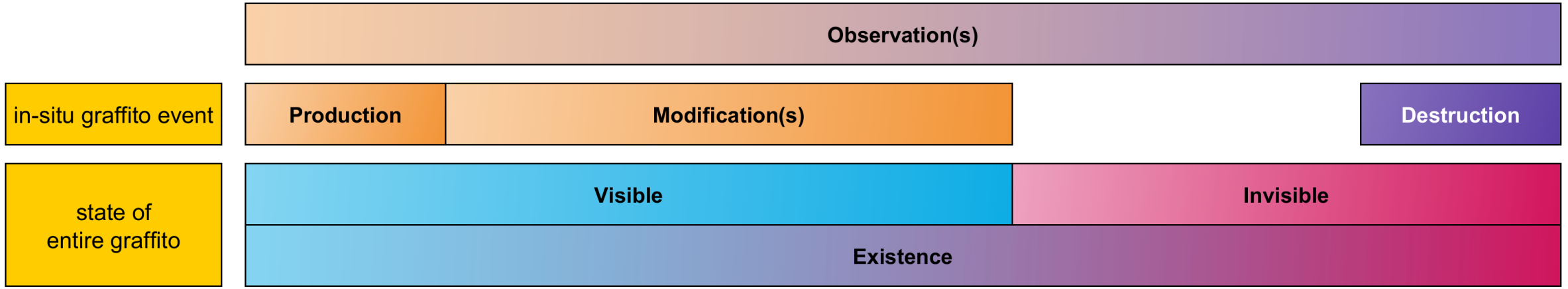
  "invisibile": {···
  },

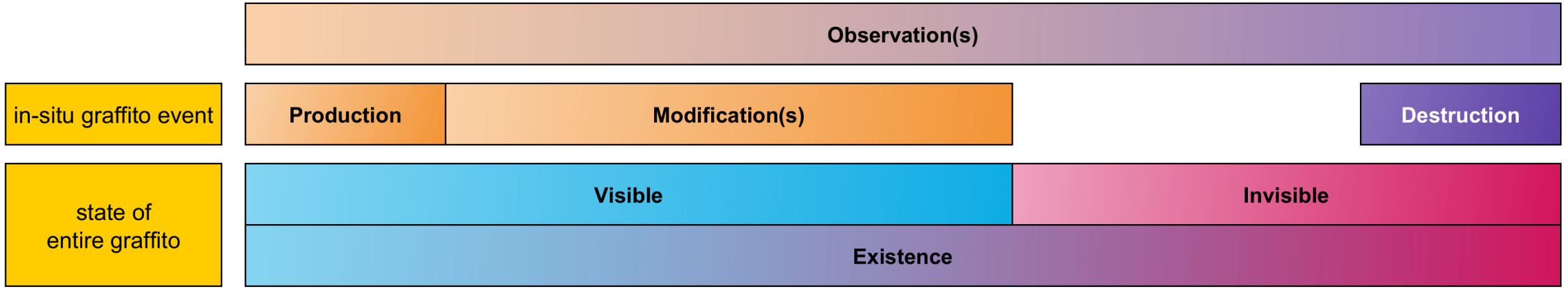
  "existence": {···
  }
```

STORING time




```
"visible": {
  "start": {                    "end": {                    "span": {
```

STORING time




```
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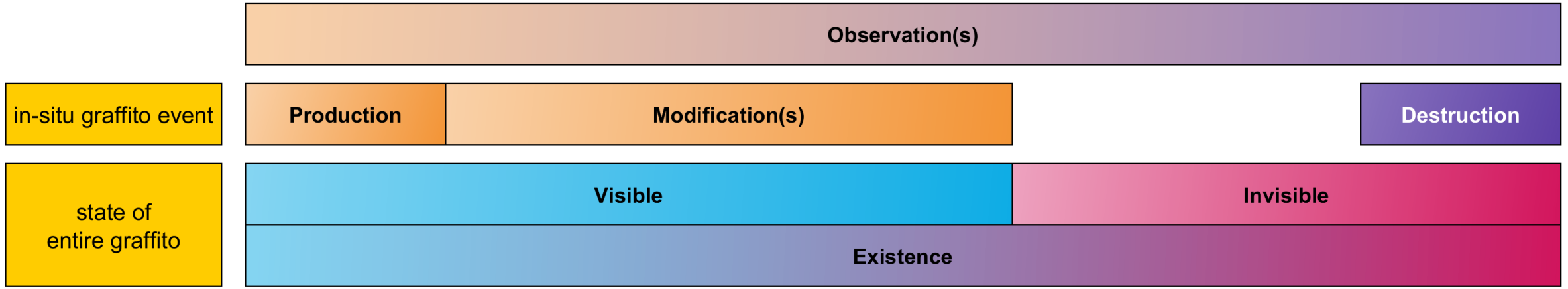
    "earliest":
    "earliest_source":
    "latest":
    "latest_source":
  },
```

```
"end": {
```

```
"span": {
```

STORING time

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"visible": {
  "start": {
    "earliest":
    "earliest_source":
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    "latest_source":
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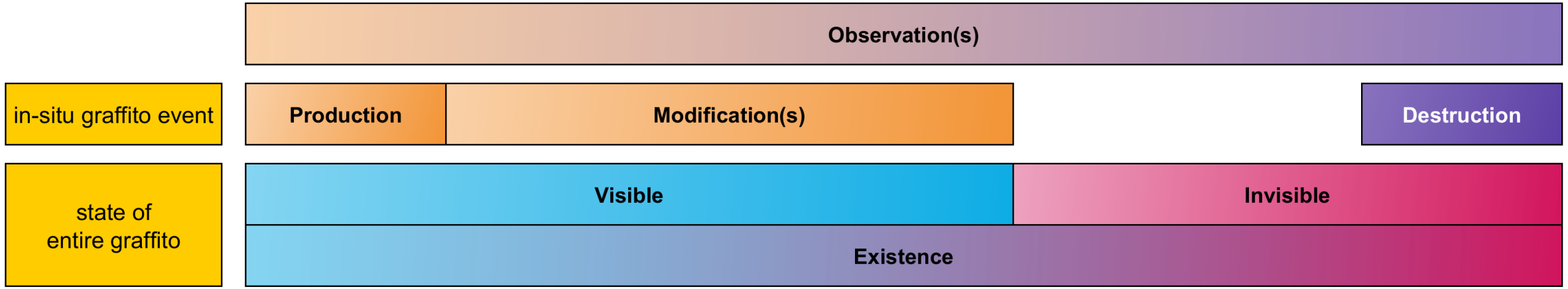
},
"span": {
```

STORING time

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"end": {
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  "latest":
  "latest_source":
},
"span": {
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  "maximum":
}
```

STORING time


```
"visible": {
  "start": {
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    "latest":
    "latest_source":
  },
"end": {
  "earliest":
  "earliest_source":
  "latest":
  "latest_source":
},
"span": {
  "minimum":
  "maximum":
}
```

STORING time


```
"visible": {
  "start": {
    "earliest":
    "earliest_source":
    "latest":
    "latest_source":
  },
```

```
"end": {
  "earliest":
  "earliest_source":
  "latest":
  "latest_source":
},
```

```
"span": {
  "minimum":
  "maximum":
}
```

STORING time


```
"visible": {
  "start": {
    "earliest":
    "earliest_source":
    "latest":
    "latest_source":
  },
"end": {
  "earliest":
  "earliest_source":
  "latest":
  "latest_source":
},
"span": {
  "minimum":
  "maximum":
}
```

STORING time


```
"visible": {
  "start": {
    "earliest":
    "earliest_source":
    "latest":
    "latest_source":
  },
"end": {
  "earliest":
  "earliest_source":
  "latest":
  "latest_source":
},
"span": {
  "minimum":
  "maximum":
}
```

STORING time


```
"visible": {
  "start": {
    "earliest":
    "earliest_source":
    "latest":
    "latest_source":
  },
"end": {
  "earliest":
  "earliest_source":
  "latest":
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},
"span": {
  "minimum":
  "maximum":
}
```

STORING time


```
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```

```
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```

```
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}
```

STORING time


```
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```

STORING time


```
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```

STORING time


```
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STORING time


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  },
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```

STORING time


```
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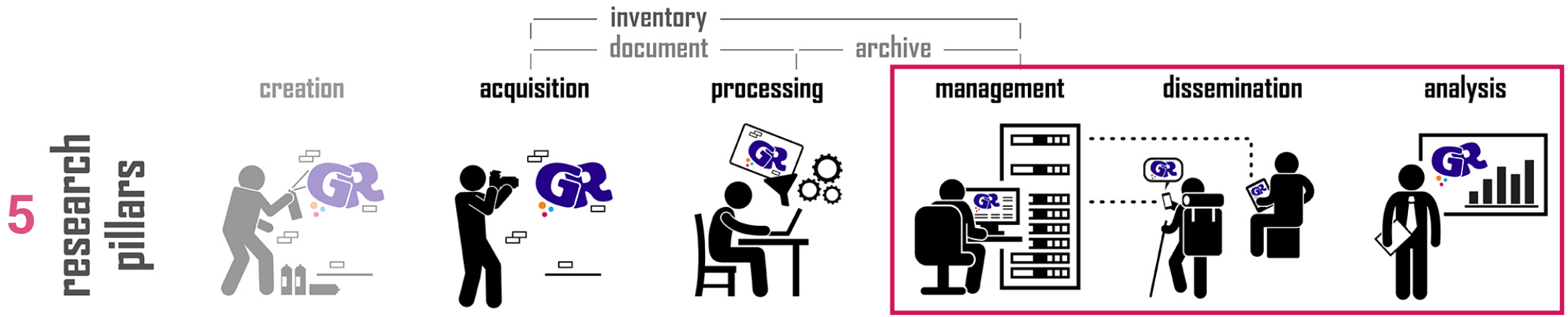
SOME results

GRAFFITI *LOCATION*

GRAFFITI *TEMPORALITY*

GRAFFITI *TERMINOLOGY*

GRAFFITI *CHARACTERISATION*



UNIFORM terminology

TERMINOLOGY & HIERARCHY

UNIFORM terminology

TERMINOLOGY & HIERARCHY

Graffiti ? Street Art ?

UNIFORM terminology

TERMINOLOGY & HIERARCHY

Graffiti ? Street Art ?

UNIFORM terminology

TERMINOLOGY & HIERARCHY

Graffiti ? Street Art ?

UNIFORM terminology

TERMINOLOGY & HIERARCHY

Graffiti ? Street Art ?

Graffiti
|___ Street Art

UNIFORM terminology

TERMINOLOGY & HIERARCHY

Graffiti ? Street Art ?

Graffiti
|___ Street Art

Street Art
|___ Graffiti

UNIFORM terminology

TERMINOLOGY & HIERARCHY

Graffiti ? Street Art ?

Graffiti
|___ Street Art

Street Art
|___ Graffiti

Graffiti | Street Art

UNIFORM terminology

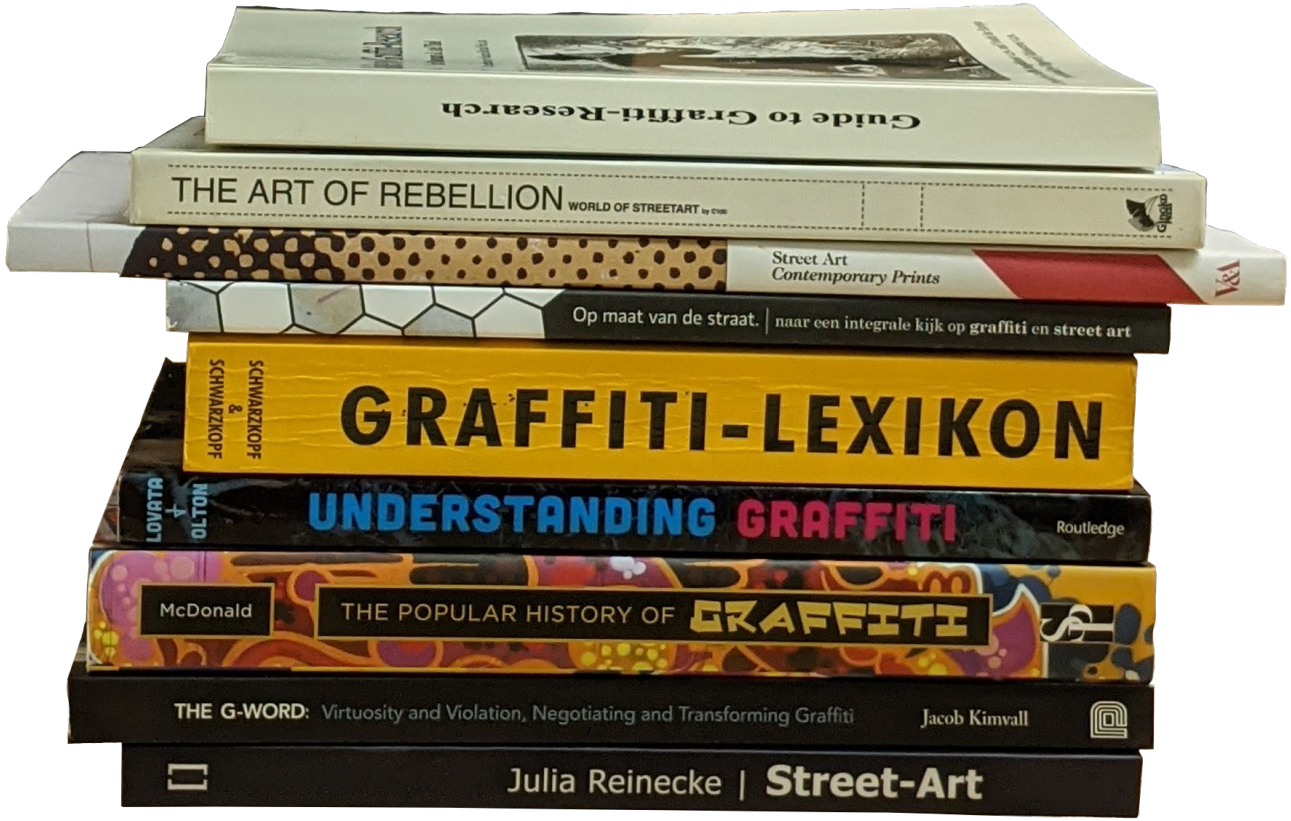
TERMINOLOGY & HIERARCHY

Graffiti ? Street Art ?

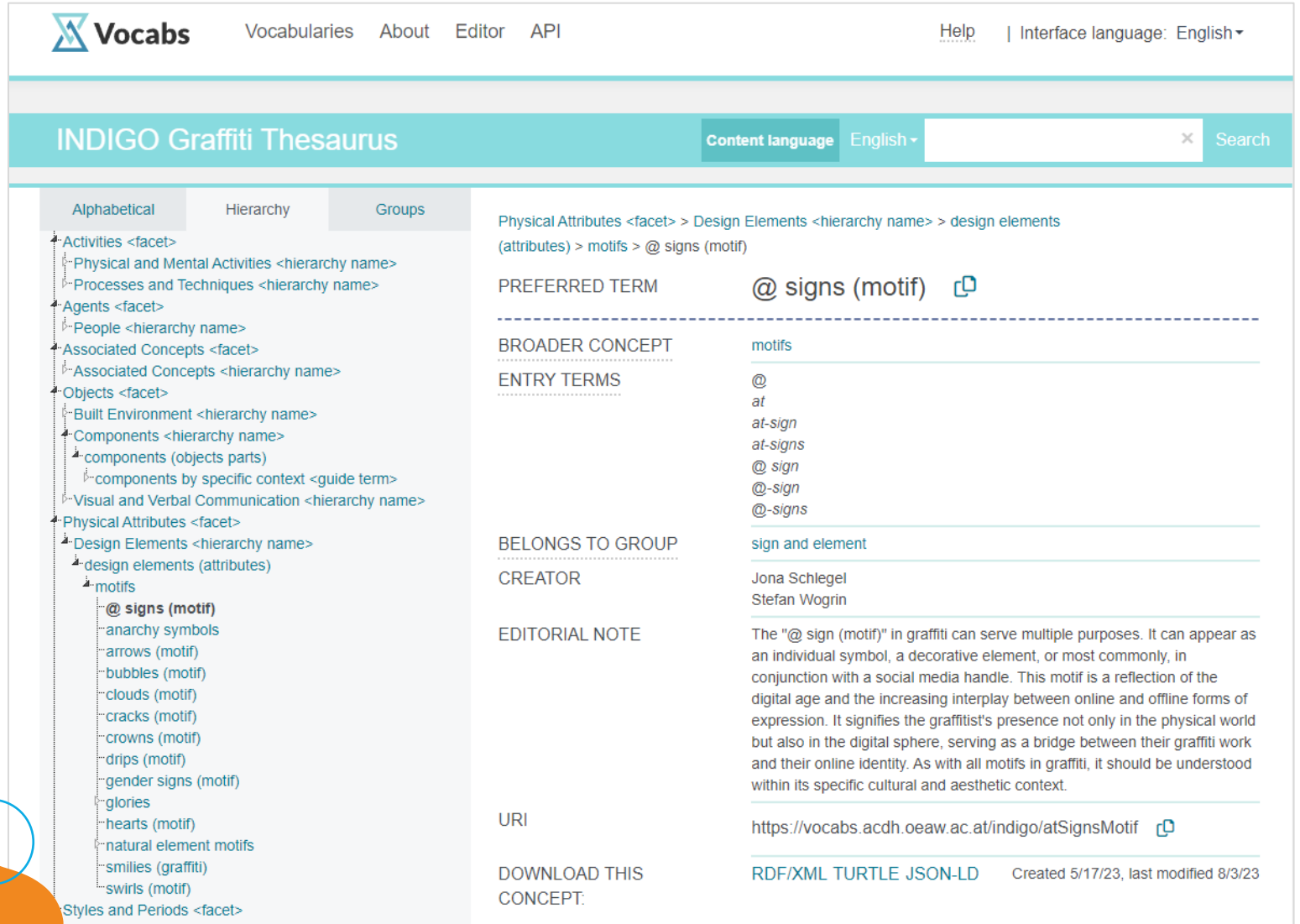
Graffiti
|___ Street Art

Street Art
|___ Graffiti

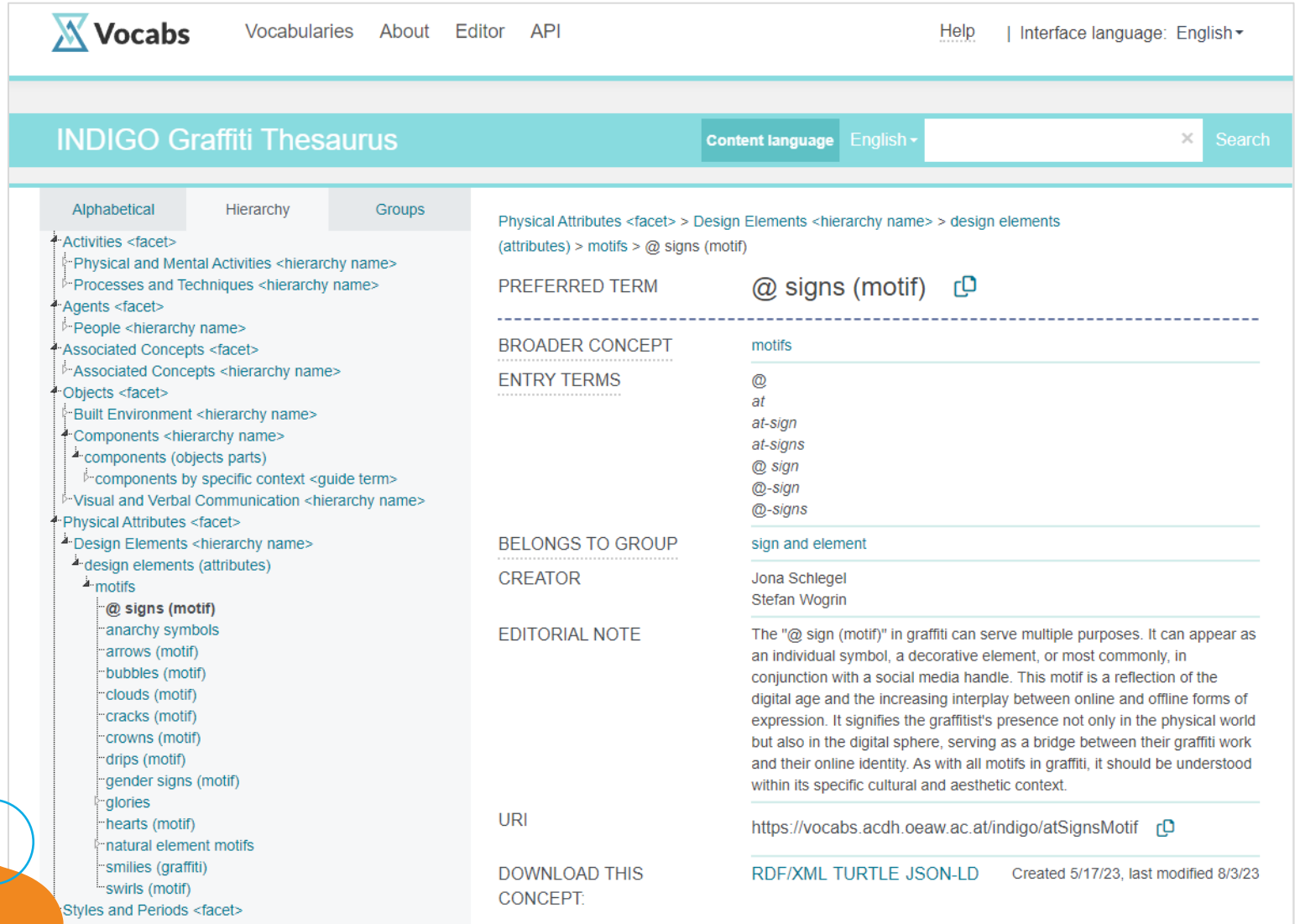
Graffiti | Street Art



GRAFFITI thesaurus

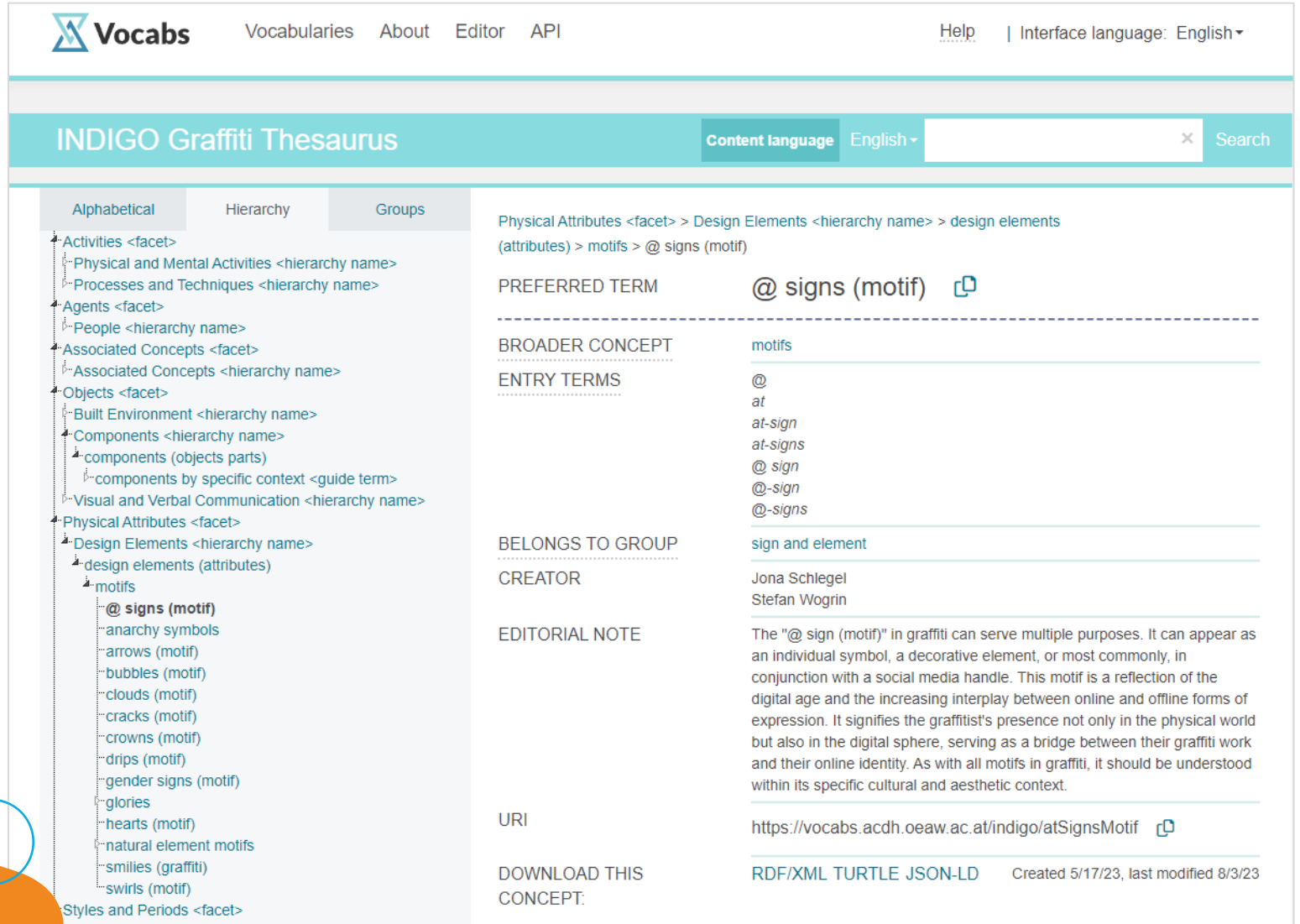


GRAFFITI thesaurus



Hierarchy

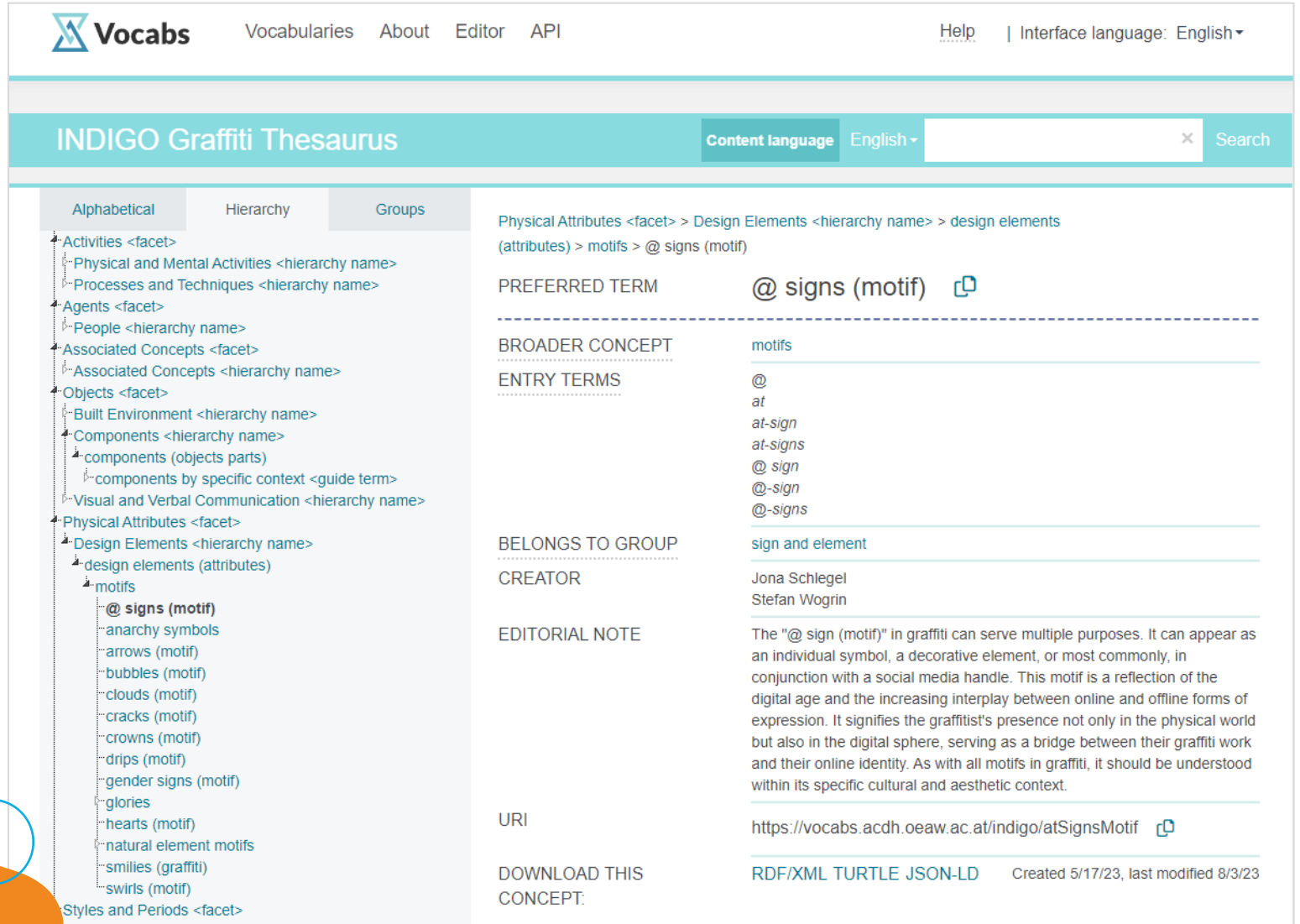
GRAFFITI thesaurus



Hierarchy

Synonyms & preferred terms

GRAFFITI thesaurus

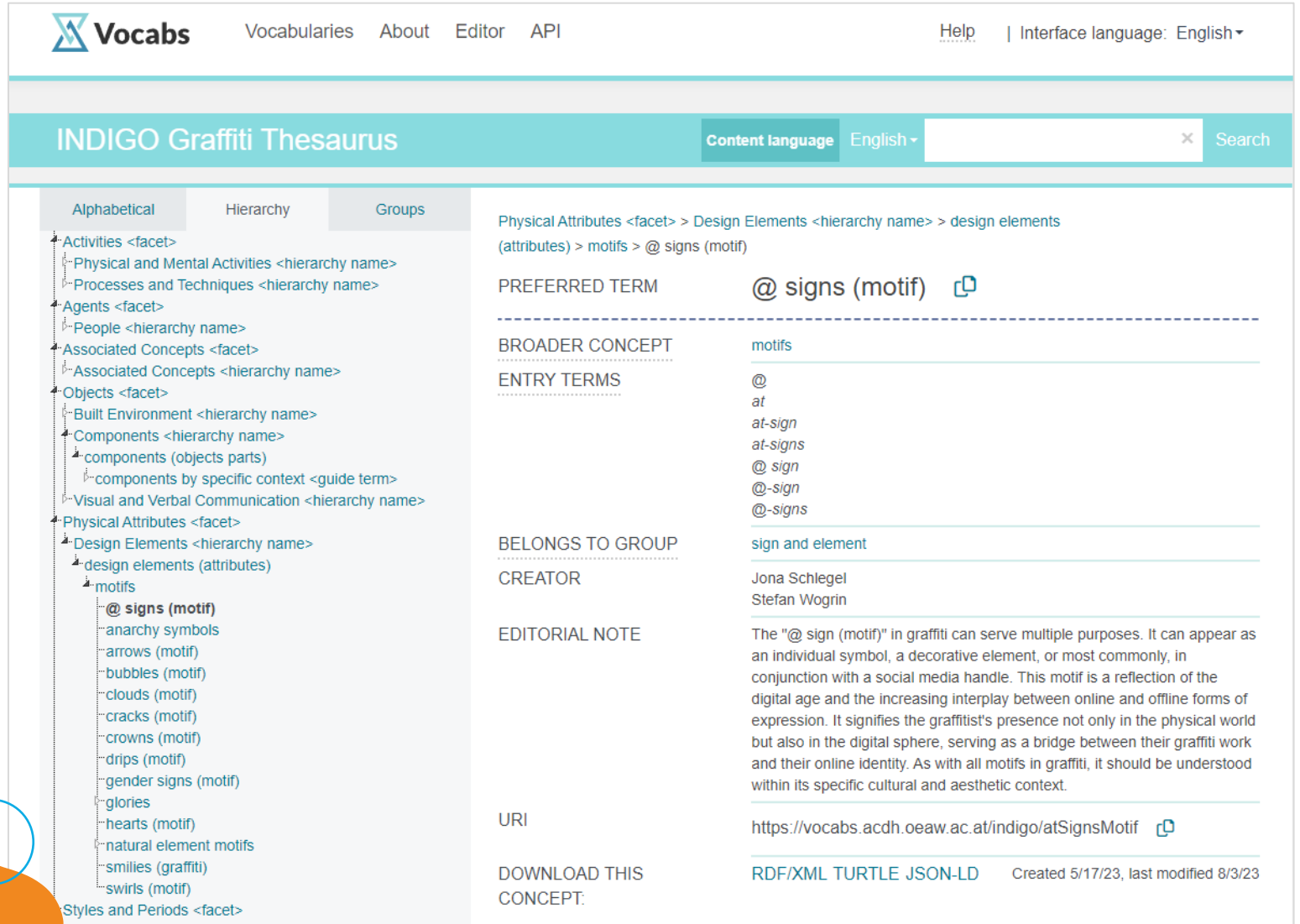


Hierarchy

Synonyms & preferred terms

URI

GRAFFITI thesaurus



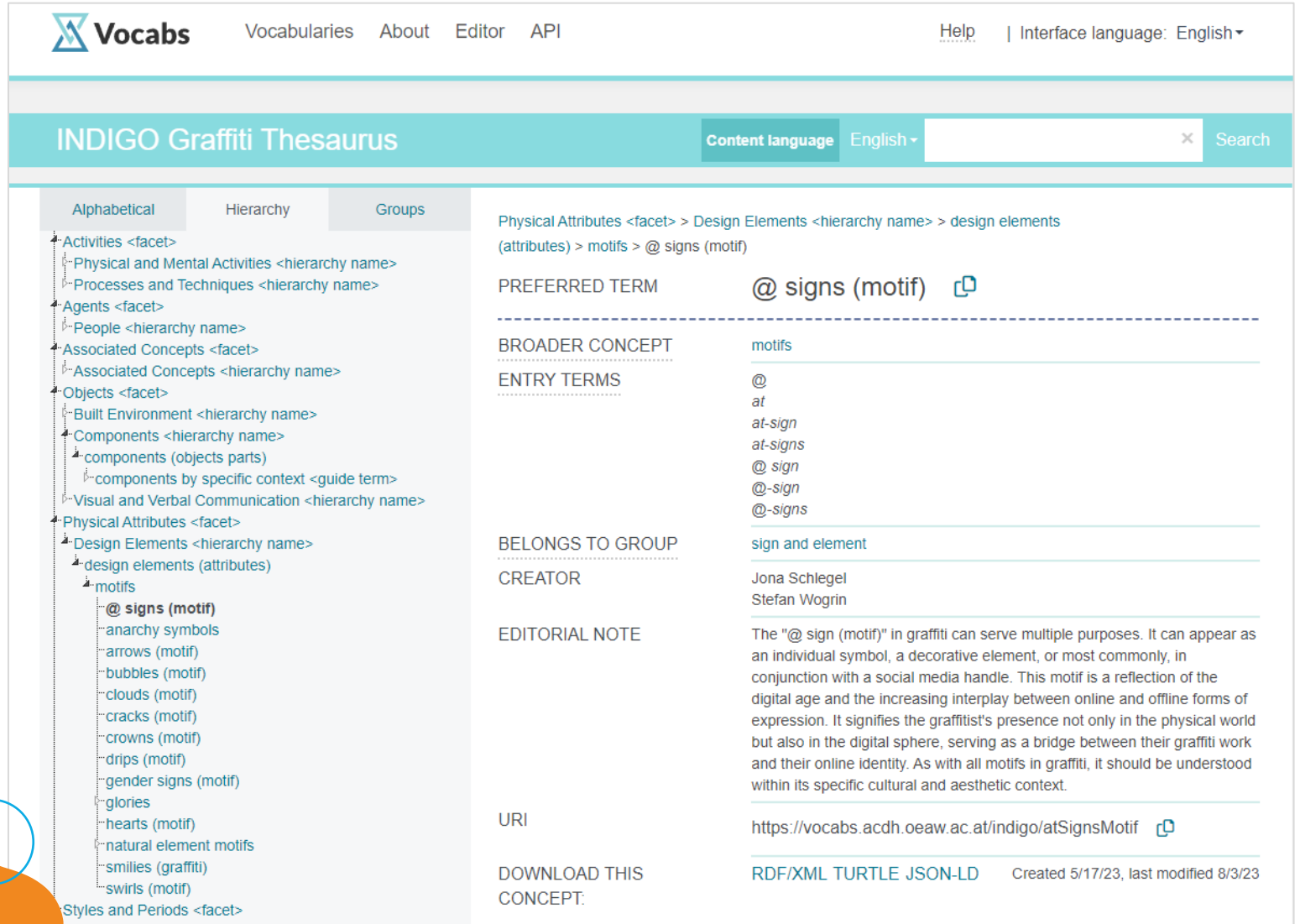
Hierarchy

Synonyms & preferred terms

URI

Semantic Web

GRAFFITI thesaurus



Hierarchy

Synonyms & preferred terms

URI

Semantic Web

Structure → Getty Art & Architecture Thesaurus

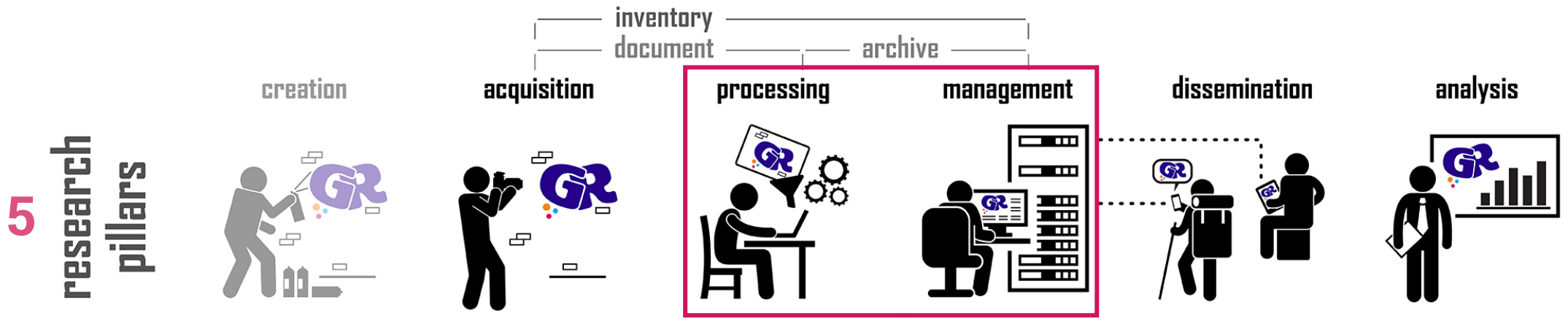
SOME results

GRAFFITI *LOCATION*

GRAFFITI *TEMPORALITY*

GRAFFITI *TERMINOLOGY*

GRAFFITI *CHARACTERISATION*



COOLPI

COOLPI

colour-accurate pixels

GraffitiProjectINDIGO / COOLPI Public

main 1 branch 0 tags Go to file Code

amolada Add files via upload 0bbf6c3 on Oct 20, 2022 155 commits

dist	Add files via upload	9 months ago
docs	Add files via upload	9 months ago
graffiti_image_processing	Add files via upload	9 months ago
notebooks	Add files via upload	10 months ago
src	Add files via upload	9 months ago
tests/coolpi-gui-test	Add files via upload	10 months ago
wpp_data	Add files via upload	10 months ago
LICENSE	Initial commit	last year
LICENSE.txt	Add files via upload	9 months ago
MANIFEST.in	Add files via upload	9 months ago
README.md	Add files via upload	9 months ago
pyproject.toml	Add files via upload	9 months ago

README.md

COOLPI

Description

COlour Operations Library for Processing Images (COOLPI) is an open-source toolbox programmed in Python for the treatment of colorimetric and spectral data. It includes classes, methods and functions developed and tested following the colorimetric standards published by the Commission Internationale de l'Éclairage (CIE, 2018).

The COOLPI package has been developed as part of the INDIGO project (IN-ventory and DI-sseminate G-raffiti along the d-O-naukanal) carried out by the Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology in close collaboration with the GEO Department of TU Wien University.

The achievement of colour-accurate digital images is one of the primary research topics within the INDIGO project. Therefore, the COOLPI package also includes specific procedures for digital image processing and colour correction, particularly from images in RAW format.

About

COlour Operations Library for Processing Images

Readme

GPL-3.0, GPL-3.0 licenses found

4 stars

0 watching

1 fork

Report repository

Releases

No releases published

Packages

No packages published

Contributors 2

amolada Adolfo Molada Tebar

BeyondConventionalBoundaries Geert ...

Languages

Jupyter Notebook 98.1% Python 1.9%

COOLPI

colour-accurate pixels

COOLPI

HUEnique
colour determination

HUEnique

HUEnique
colour determination

HUEnique

HUEnique
colour determination

HUEnique

HUEnique
colour determination

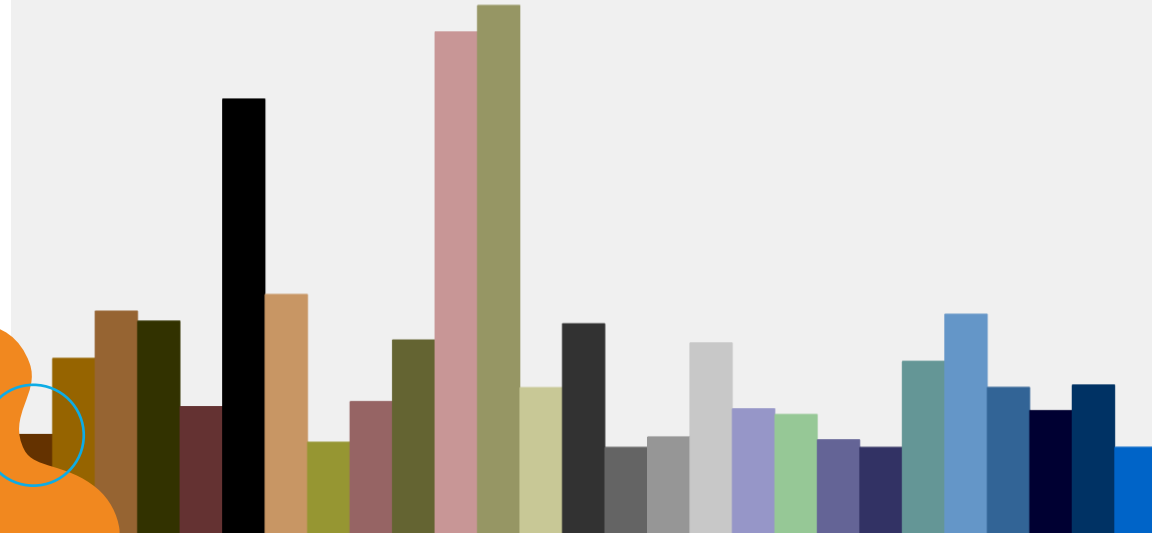
HUEnique

HUEnique
colour determination

HUEnique

HUEnique
colour determination

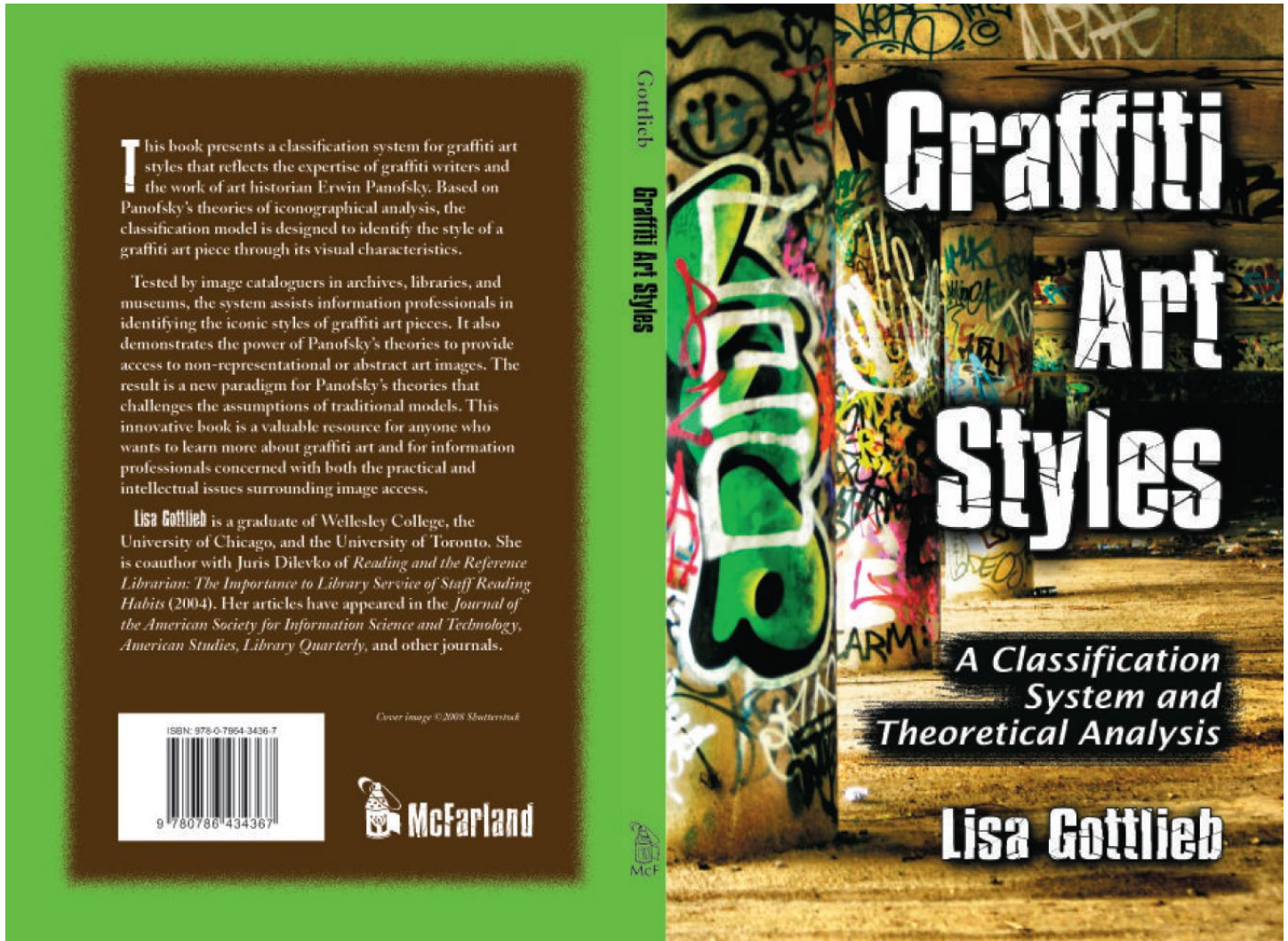
HUEnique



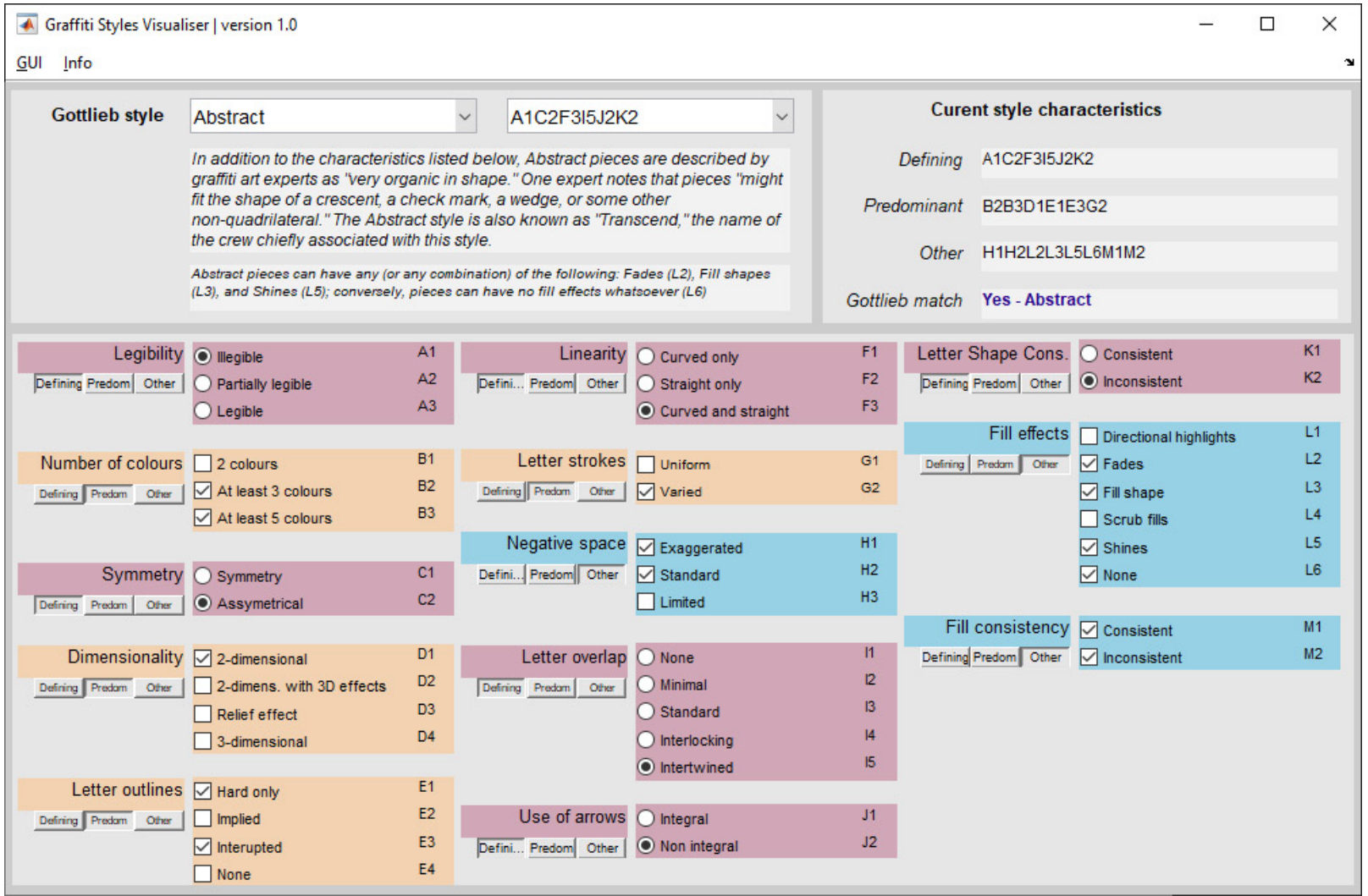
HUEnique
colour determination

HUEnique

GRAFFITI styles



GRAFFITI styles



SOME results

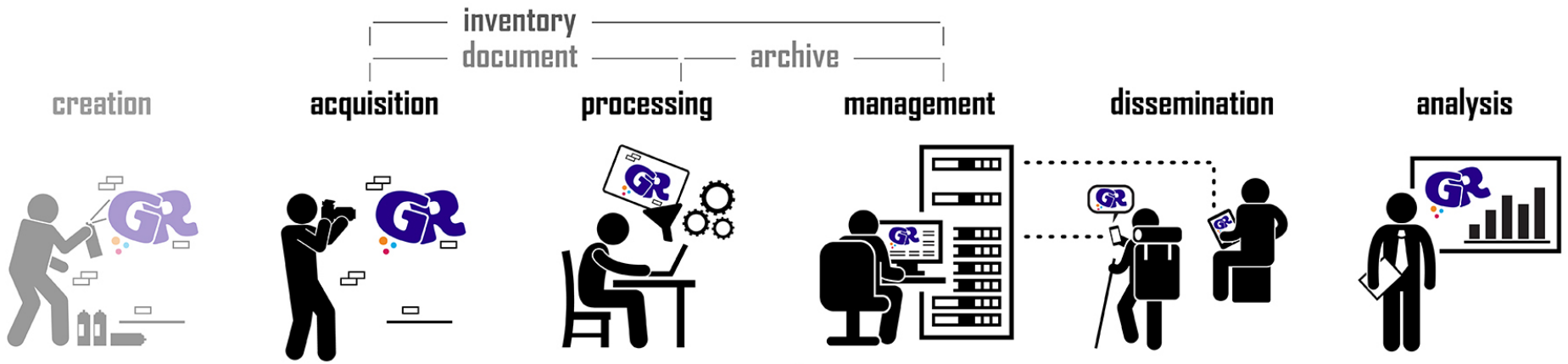
GRAFFITI *LOCATION*

GRAFFITI *TEMPORALITY*

GRAFFITI *TERMINOLOGY*

GRAFFITI *CHARACTERISATION*

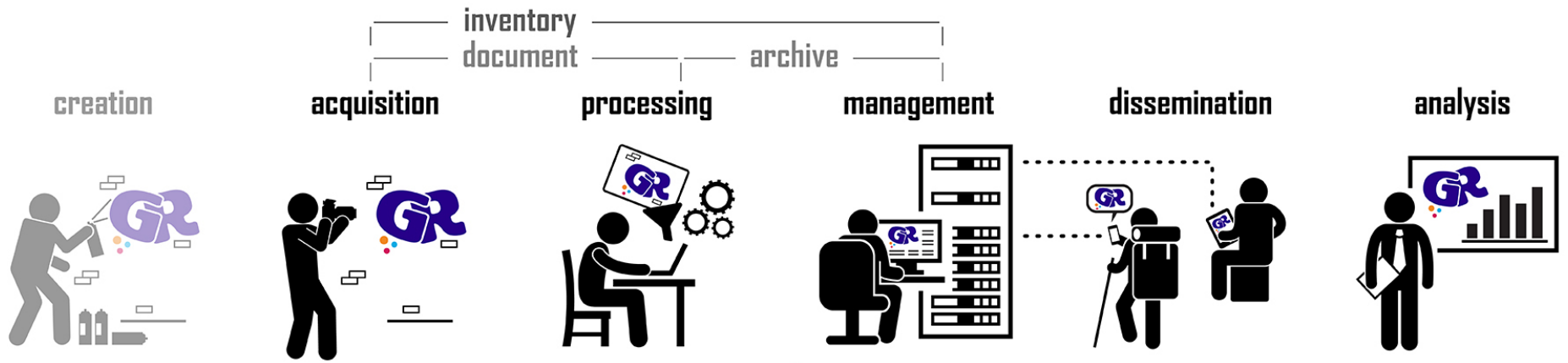
5 research pillars



GRAFFITI metadata

GRAFFITI *LOCATION*
GRAFFITI *TEMPORALITY*
GRAFFITI *TERMINOLOGY*
GRAFFITI *CHARACTERISATION*

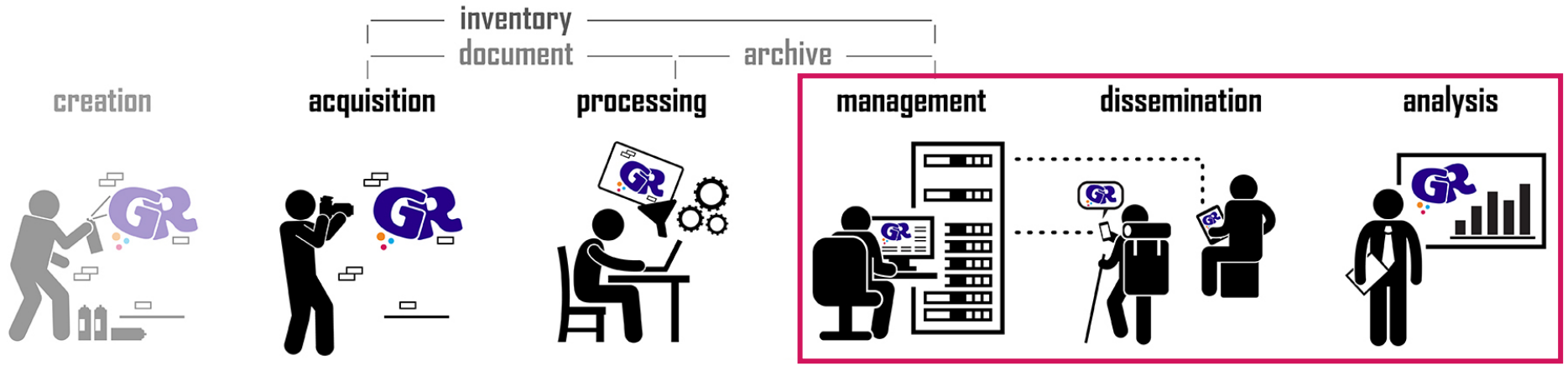
5 research pillars



GRAFFITI metadata

GRAFFITI *LOCATION*
GRAFFITI *TEMPORALITY*
GRAFFITI *TERMINOLOGY*
GRAFFITI *CHARACTERISATION*

5 research pillars



INDIGO
core division

INDIGO
core division

real graffito
physical resource

INDIGO
core division

real graffito
physical resource

approximations
digital resources

INDIGO
core division

real graffito
physical resource

approximations
digital resources

digital photos

textured 3D models

orthophotographs

polygons

INDIGO
core division

real graffito
physical resource

approximations
digital resources

digital photos

textured 3D models

orthophotographs

polygons

metadata

metadata

INDIGO
core division

real graffito
physical resource

approximations
digital resources

digital photos

textured 3D models

orthophotographs

polygons

metadata ⇦ metadata

INDIGO
core division

real graffito

digital resources

digital photos

textured 3D models

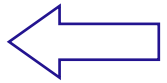
orthophotographs

polygons

metadata

GRAFFITI (meta)data

INDIGO metadata (physical graffito)	
Category Level	**Category Name**
1	**Descriptive metadata**
1.1	Core metadata
1.2	Locational metadata
1.3	Temporal metadata
1.4	Contentual / aboutness metadata
1.5	Formal / appearance metadata
2	**Administrative metadata**
2.1	Rights metadata
2.2	Access metadata
2.3	Technical metadata
3	**Structural metadata**
3.1	Origin relationships
3.2	Graffiti ensemble relationships
3.2	Spatio-temporal relationships



metadata

digital photos

textured 3D models

orthophotographs

polygons

GRAFFITI (meta)data

INDIGO metadata (physical graffito)	
Category Level	**Category Name**
1	**Descriptive metadata**
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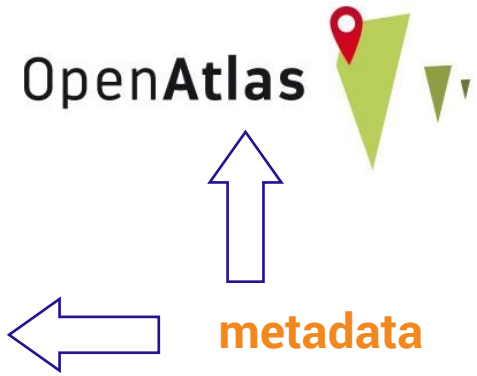


digital photos

textured 3D models

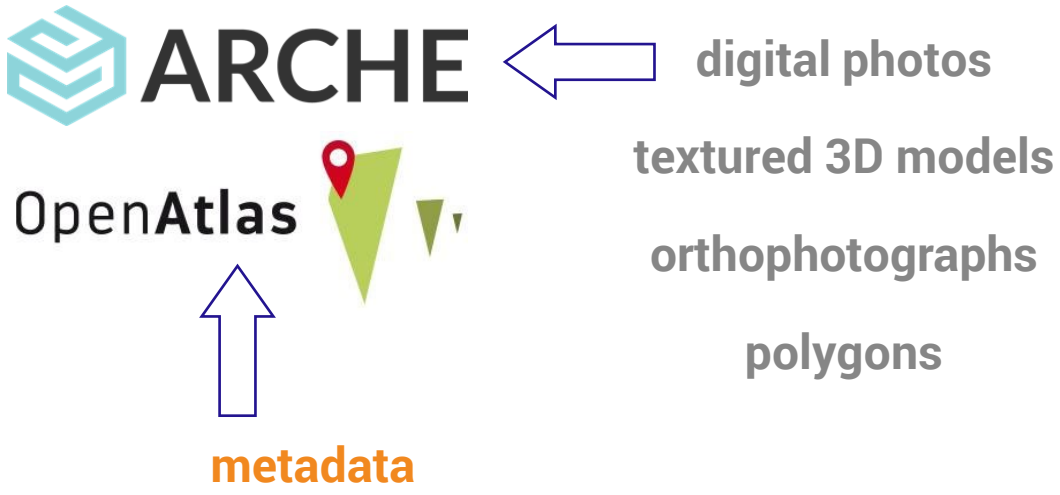
orthophotographs

polygons

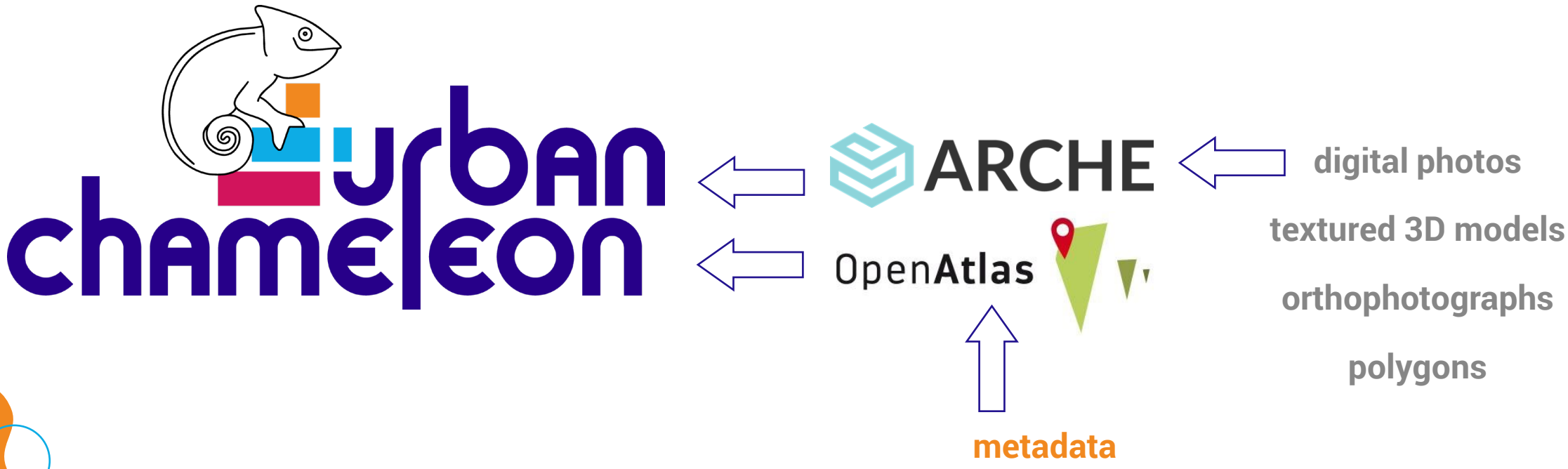
GRAFFITI (meta)data

INDIGO metadata (physical graffito)	
Category Level	**Category Name**
1	**Descriptive metadata**
1.1	Core metadata
1.2	Locational metadata
1.3	Temporal metadata
1.4	Contentual / aboutness metadata
1.5	Formal / appearance metadata
2	**Administrative metadata**
2.1	Rights metadata
2.2	Access metadata
2.3	Technical metadata
3	**Structural metadata**
3.1	Origin relationships
3.2	Graffiti ensemble relationships
3.2	Spatio-temporal relationships

FINAL goal

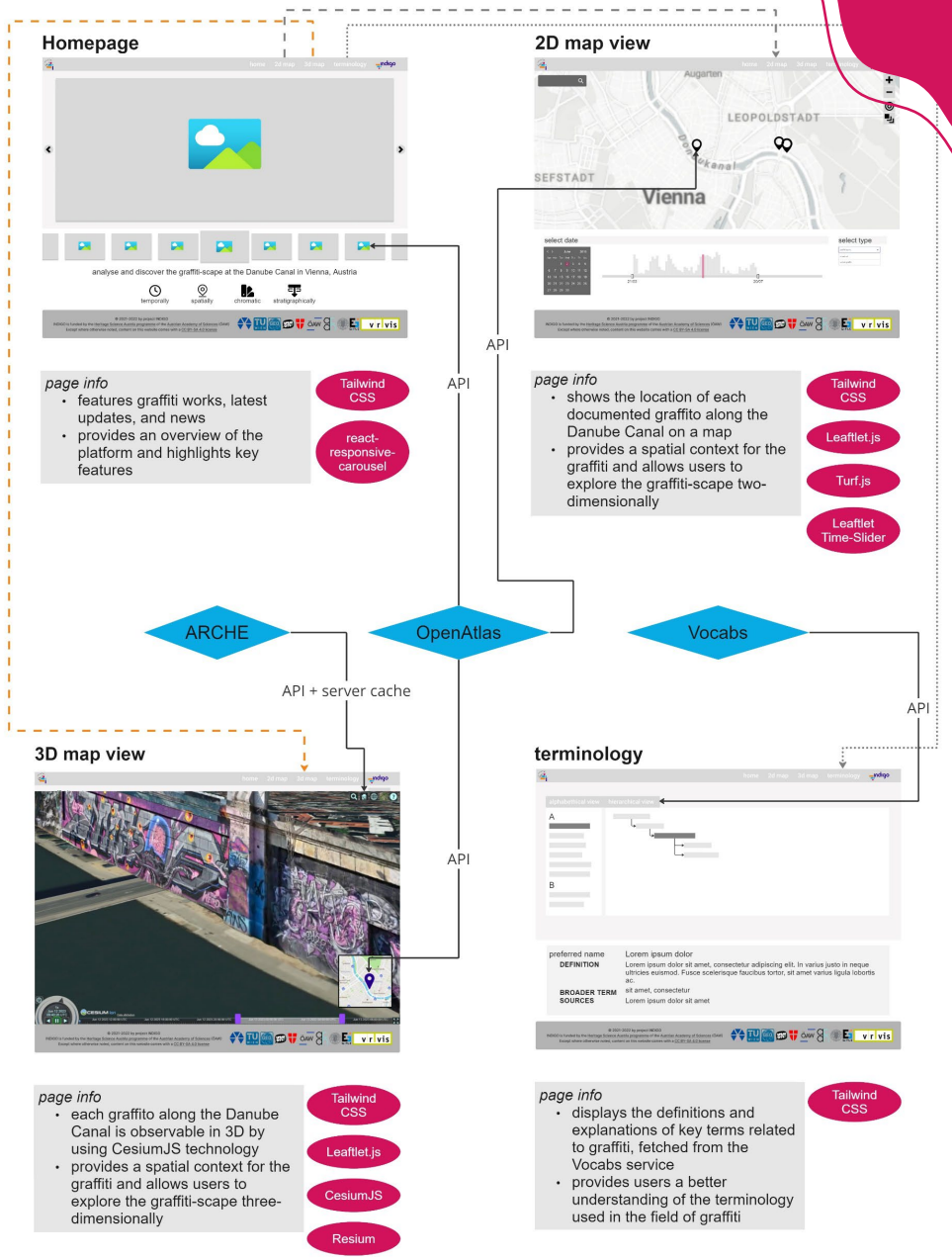

ARCHE
digital photos
textured 3D models
orthophotographs
polygons
OpenAtlas
metadata

FINAL goal


urban chameleon
ARCHE
OpenAtlas
digital photos
textured 3D models
orthophotographs
polygons
metadata

FINAL goal

urban chameleon



INTERACTIVE 3D
dissemination

archaeologists / art historians

sociologists / linguists

ethnographers / anthropologists

architects / geographers

INTERACTIVE 3D
dissemination

archaeologists / art historians

sociologists / linguists

ethnographers / anthropologists

architects / geographers

ETHICAL + COPYRIGHT aspects

RIGHT now

RIGHT now

DATA, LOTS OF DATA

RIGHT now

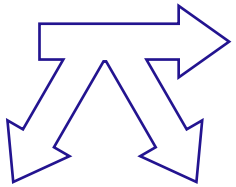
DATA, LOTS OF DATA

ARCHE

CoreTrustSeal certified data repository

RIGHT now

DATA, LOTS OF DATA

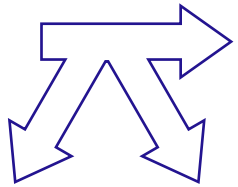


ARCHE

CoreTrustSeal certified data repository

RIGHT now

DATA, LOTS OF DATA



ARCHE

CoreTrustSeal certified data repository

~~PHOTO METADATA CONFLICTS~~

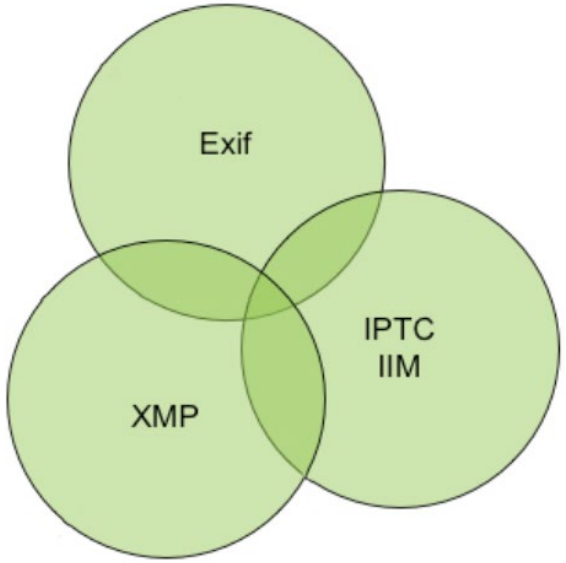
RIGHT now

DATA, LOTS OF DATA

ARCHE

CoreTrustSeal certified data repository

~~PHOTO METADATA CONFLICTS~~



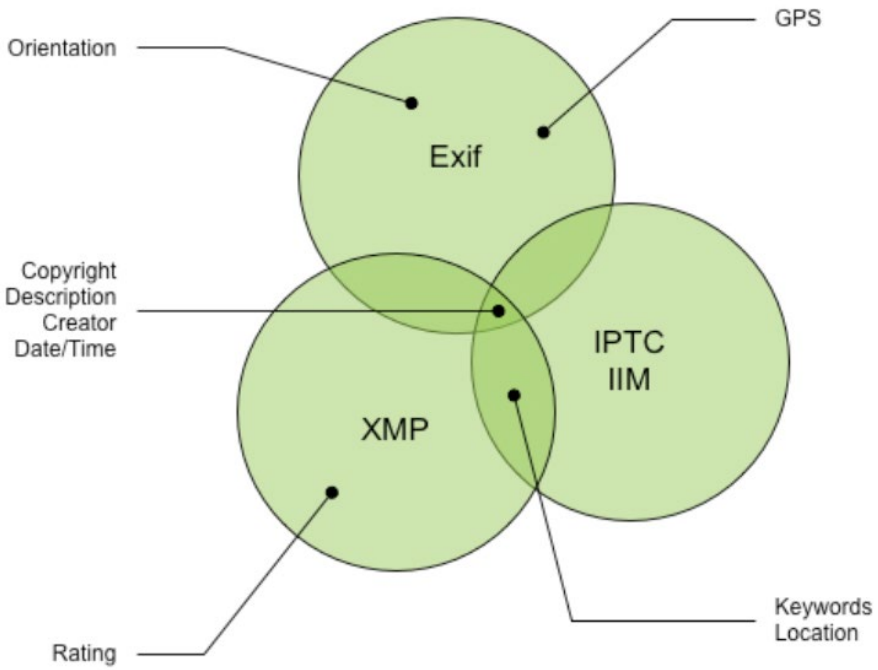
RIGHT now

DATA, LOTS OF DATA

ARCHE

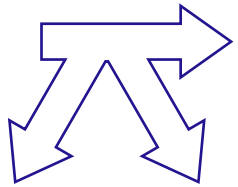
CoreTrustSeal certified data repository

~~PHOTO METADATA CONFLICTS~~



RIGHT now

DATA, LOTS OF DATA



ARCHE

CoreTrustSeal certified data repository

~~PHOTO METADATA CONFLICTS~~

JPG

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```

NEF

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[XMP:XMP-crd]   Highlights 2012               : -49
[XMP:XMP-crd]   Shadows 2012                  : 10
[XMP:XMP-crd]   Luminance Smoothing           : 32
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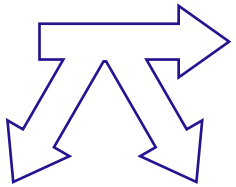
RIGHT now

DATA, LOTS OF DATA



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CoreTrustSeal certified data repository

~~PHOTO METADATA CONFLICTS~~

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NEF

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[XMP:XMP-xmp]    Rating                          : 0
[XMP:XMP-crd]    Exposure 2012                   : 1.00
[XMP:XMP-crd]    Highlights 2012                 : -49
[XMP:XMP-crd]    Shadows 2012                    : 10
                                                 : 32
                                                 : 75
                                                 : 0
                                                 : 10
                                                 : 50
                                                 : 50
                                                 : 40
                                                 : 2.00
                                                 : 25
                                                 : 0
                                                 : 0
                                                 : 0
                                                 : Camera Standard
```

XMP

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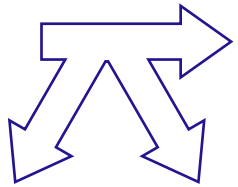
- [IFD0]:Artist not mapped to [XMP-dc]:Creator (embedded).
- [IFD0]:Artist not mapped to [XMP-tiff]:Artist (embedded).
- [IFD0]:Orientation not mapped to [XMP-tiff]:Orientation (embedded).
- [ExifIFD]:UserComment not mapped to [XMP-dc]:Description (embedded).

RIGHT now

DATA, LOTS OF DATA



ARCHE

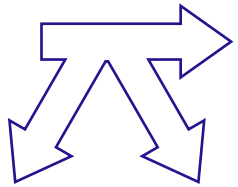
CoreTrustSeal certified data repository

~~PHOTO METADATA CONFLICTS~~

ANONYMISATION

RIGHT now

DATA, LOTS OF DATA



ARCHE

CoreTrustSeal certified data repository

~~PHOTO METADATA CONFLICTS~~

ANONYMISATION

Celantur

RIGHT now

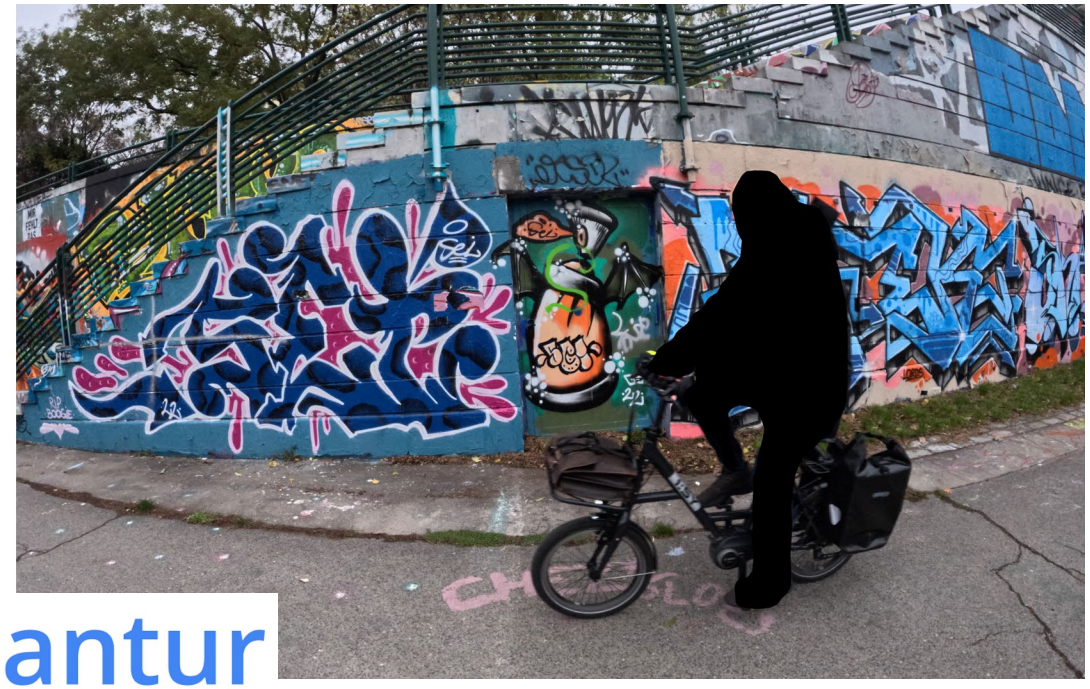
DATA, LOTS OF DATA

ARCHE

CoreTrustSeal certified data repository

PHOTO METADATA CONFLICTS

ANONYMISATION



Celantur

RIGHT now

DATA, LOTS OF DATA

ARCHE

CoreTrustSeal certified data repository

PHOTO METADATA CONFLICTS

ANONYMISATION

RIGHT now

DATA, LOTS OF DATA

ARCHE

CoreTrustSeal certified data repository

PHOTO METADATA CONFLICTS

ANONYMISATION

DISSEMINATION general audience

DISSEMINATION general audience

NewsLetter

vol.24 · Week 40 · 03-07 October 2022

indigo

VRVis meeting

01 Thursday 06-10-2022
10:00 @ VRVis
discuss collaboration

bot character by DEADBEAT HERO south of the Friedensbrücke on the right Donaukanal bank [21-09-2022]
Nikon Z 7II + Nikon NIKKOR Z 20mm f/1.8 S @ *f*/5.6 - 1/400 s - ISO 360

CVL Computer Vision Lab

UC

last two weeks

1. CVL meeting

Tuesday 27-09-2022 | meeting between Sebastian Zambanini of the TU Wien's Computer Vision Lab and Geert to discuss potential thesis subjects

2. Proceedings meeting

Wednesday 28-09-2022 | the editors of the goINDIGO 2022 proceedings meet to sync info about article submissions and outstanding papers

3. Monthly team meeting

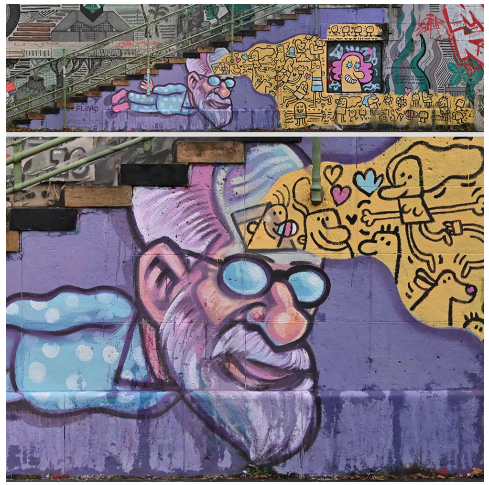
Friday 30-09-2022 | during monthly team meeting 11, the INDIGO project staff discussed the status quo and talked about upcoming matters

NEWSLETTER

26

DISSEMINATION general audience

Gallery Wednesday



NEWSLETTER

26

INSTAGRAM

±500

DISSEMINATION general audience

Die Presse SAMSTAG, 16. JULI 2022 WISSEN & INNOVATION W3

Digital. Ein Forschungsteam entwickelt ein 3-D-Modell der unzähligen Graffiti am Donaukanal: um die kurzlebigen Werke zu bewahren und eine Basis für andere Forschungen schaffen. Zu Besuch bei einer der längsten Graffitiflächen der Welt.

Buntes Erbe zum Lachen, Ärgern und Grübeln

VON ALICE SENARCLENS DE GRANCY

Wir haben seit fast vier Jahren einen Hund und gehen mit ihm oft im Prater spazieren, aber auch entlang des Donaukanals", erzählt Geert Verhoeven von der Idee zu seinem aktuellen Forschungsprojekt. Dabei betrachtete er die Graffiti an den Wänden – „manche waren weniger schön, manche wirkten wie Kunst" – und bemerkte auch deren Vergänglichkeit: „Sie werden teilweise nach ein paar Stunden oder Tagen übersprüht." Der Archäologe begann, die oft kurzlebigen Werke als Kulturerbe zu sehen, das es zu bewahren gilt, und startete gemeinsam mit dem Kunsthistoriker Stefan Wogrin und anderen wissenschaftlichen Partnern das Projekt Indigo (Inventory and Disseminate Graffiti along the Donaukanal).

„Der Donaukanal ist heute berühmt für die vielen Graffiti, dabei wissen die meisten nicht, dass Sprayen eigentlich nur auf 300 Metern erlaubt ist", erzählen die beiden Männer an diesem windigen und untypisch kalten Sommertag vor der Kaiserbadschleuse. Hier entstand 1984 neben dem Nachtclub Flex die erste legale Graffitofläche Wiens. Anfang und Ende sind mit einer – bunt besprühten – Reliefplatte markiert, auf der eine Taube zu sehen ist: Die sogenannte Wienerwand sei ein Unikum mit klarer Botschaft, berichtet Wogrin, der sich seit rund 20 Jahren mit Graffiti befasst – und selbst anfertigt: „Man wollte die Sprayer genauso wenig wie die Tauben." Dennoch ermöglicht es die Stadt Wien Künstlerinnen und Künstlern aus der Graffito-Szene so, auf diesen Flächen zu arbeiten, ohne kriminell zu sein.

Thema lässt niemanden kalt

Denn Graffiti polarisieren bis heute. „Die einen lieben sie, die anderen hassen sie", sagt Verhoeven, der diese Reaktionen auch von wissenschaftlichen Tagungen kennt: „Es gibt jedes Mal 100.000 Fragen." Das Interesse gefällt ihm – und auch, dass ein Beitrag aus seiner Forschungsgruppe im März einen Best Paper Award bei einer Konferenz im italienischen Mantua gewonnen hat. Üblicherweise befasst er sich als stellvertretender Leiter des Ludwig-Boltzmann-Instituts (LBI) für Archäologische Prospektion und Virtuelle Archäologie mit ganz anderen Kulturschätzen: Er begleitete die Forschungen rund um das jungsteinzeitliche Stonehenge, war bei den Arbeiten zum römischen Carnuntum oder der Wikinger-Fundstätte Birka dabei. „Und im Stephansdom habe ich Fresken dokumentiert und publiziert", schildert Geert Verhoeven, der 2010 innerhalb von vier Tagen sein Haus in Belgien verkauft hat und für die Forschungsstelle nach Wien gezogen ist. Die am LBI genutzten und weiterentwickelten Messsysteme und Simulationsmethoden bilden die Klammer über die verschiedenen Themen. Ziel ist stets, Kulturerbe digital festzuhalten.

Außergewöhnlicher Kulturschatz: Geert Verhoeven (l.) und Stefan Wogrin vor einem ihrer Forschungsobjekte. [Jana Madzigon]

IN ZAHLEN

13 Kilometer lang sind die Flächen am Donaukanal, an denen Wiener Forscher Graffiti fotografisch festhalten und daraus ein 3-D-Modell bauen.

27.000 Fotos verknüpfte das erste Modell. Wöchentlich kommen zwischen 1000 und 3000 neue Bilder dazu.

300 Meter misst der Bereich, in dem Sprayen am Wiener Donaukanal legal ist.

Digitaler Spaziergang am Kanal

Diese virtuellen Werkzeuge sollen nun auch helfen, die Graffiti am Donaukanal darzustellen – auch Anwendungen für den Tourismus sind denkbar: Den Forschern schwebt ein digitaler Spaziergang am Donaukanal vor, bei dem man auch ältere, an einer Stelle vorhandene Graffiti anschauen und mehr über sie erfahren kann.

Doch noch sind große technische Hürden zu nehmen: Die Farben bei ständig wechselnden Lichtverhältnissen richtig abzubilden, sei sehr schwierig, führt das Duo aus. Auch die Orte ändern sich: „Die Container da drüben waren vor fünf Monaten noch nicht da", sagt Wogrin und zeigt auf die bunt besprühten Quader am anderen Ufer. Zumindest einmal pro Woche geht er daher den Kanal ab dem Hunderwasserhaus bis zur Friedensbrücke auf beiden Seiten ab, sichtet Neuheiten und macht unzählige Fotos, die später zum großen Ganzen kommen.

Rund 27.000 Fotos bildeten das Basismodell. Seither werden – wie bei einem Puzzle – ständig neue hinzugefügt und beschrieben: Welche Figuren sind dargestellt, was steht geschrieben? Gewaltige Datenmengen müssen richtig verknüpft werden. Dabei unterstützen auch Forschungsteams der TU Wien und der Universitat Politècnica de València in Spanien. Auch das VRVis, das Zentrum für Virtual Reality und Visualisierung in Wien, soll künftig helfen, das Neuland zu ergründen. „Es gibt noch keine Projekte, die können, was wir brauchen", erläutert Verhoeven.

Schließlich soll, unterstützt vom Förderprogramm Heritage Science Austria der Österreichischen Akademie der Wissenschaften, ein öffentlich zugängliches Archiv entstehen, das weltweit kein Pendant findet. Der Donaukanal sei, zusammen mit der Berliner Mauer, wohl die längste ununterbrochene Graffitifläche der Welt, so Verhoeven – und in Bezug auf die Graffitiforschung „definitiv die längste". Die Daten sollen dann Disziplinen wie Soziologie, Linguistik, Kriminologie oder Kunstgeschichte für ihre Forschung offenstehen.

Putin, dargestellt als Hitler

Inhaltliche Analysen folgen also später, doch aus seinen Beobachtungen weiß Wogrin schon heute: „Die Motive haben oft einen Bezug zum Kanal. Man sieht viele Fische oder Fischskelette oder auch Oktopusse." Für politische Botschaften werde meist mit Schablonen gearbeitet, so ließen sich Parolen schnell aufsprühen. Darin habe man zuletzt auch den Beginn des Ukraine-Kriegs gespürt, fand Putin als Hitler dargestellt und einzelne Säulen mit den Farben der Ukraine gelb-blau bemalt. Aber es gibt Graffiti, die für noch mehr Diskussionsstoff sorgen: „Was tun mit homophoben oder nationalsozialistischen Botschaften?", fragt Verhoeven. „Als Forscher wollen wir alle Daten anbieten, aber freilich keine Bühne für Neonazis sein."

Überdies soll ein Thesaurus entstehen, der die Terminologie erklärt und vereinheitlicht. „Ist es Street-Art oder Graffito? Sind es Writers, Creators oder Künstler, die hier wirken?", verdeutlicht Wogrin offene Fragen. Bis zum Projektende im Juli 2023 wird die Datenbank jedenfalls noch ordentlich wachsen. Er hoffe, dass das Projekt dann immer noch gefördert werde, sagt Verhoeven. Denn er will das Neuland hier am Kanal, auf das ihn einst sein Hund geführt hat, weiter für die Nachwelt dokumentieren.

Die Presse 16/07/2022

NEWSLETTER

26

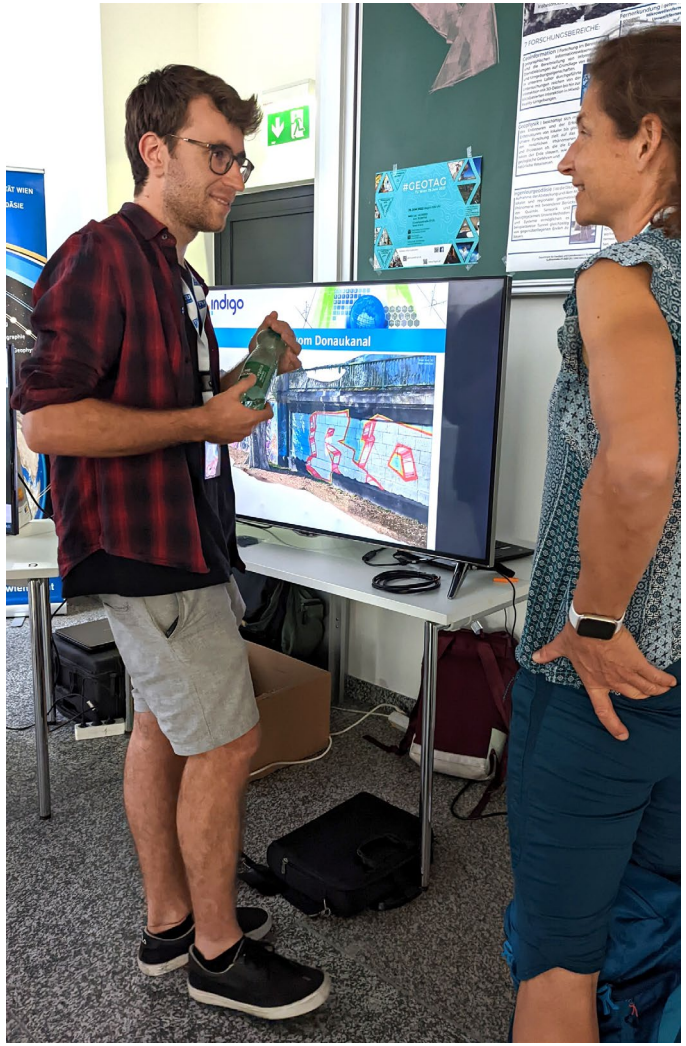
PRESS

2

INSTAGRAM

±500

DISSEMINATION general audience



Lange Nacht Der Forschung 2022

NEWSLETTER
26

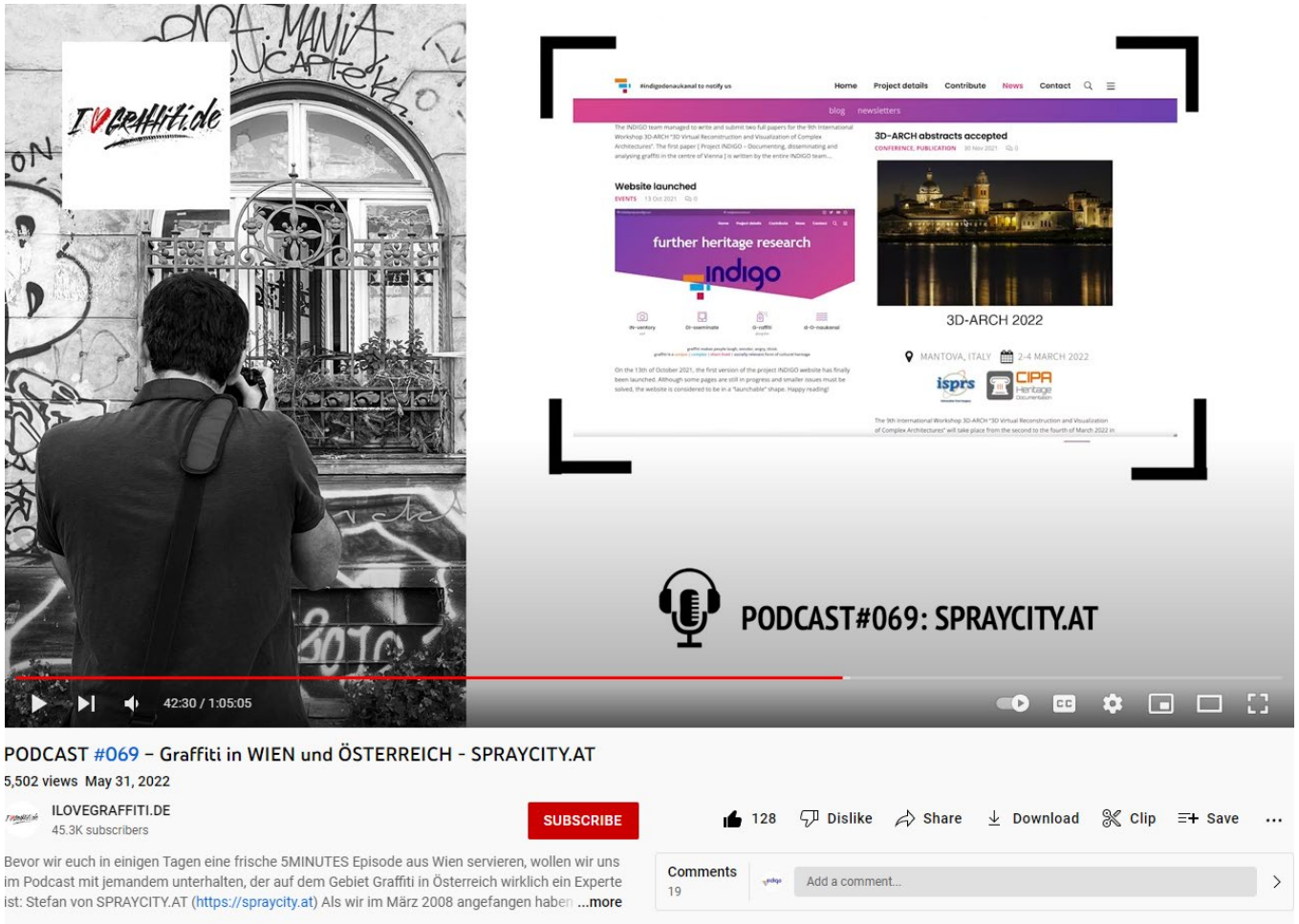
PRESS
2

INSTAGRAM
±500

EVENTS
5

DISSEMINATION general audience

ILOVEGRAFFITI.DE Podcast 69



PODCASTS

3

DISSEMINATION general audience

GEObranchen.de

PODCASTS

3

BLOGS

4

DISSEMINATION scientific audience

DISSEMINATION scientific audience

AUTOGRAF

COOLPIR

GRAPHIS

SOFTWARE

3

DISSEMINATION scientific audience

SOFTWARE

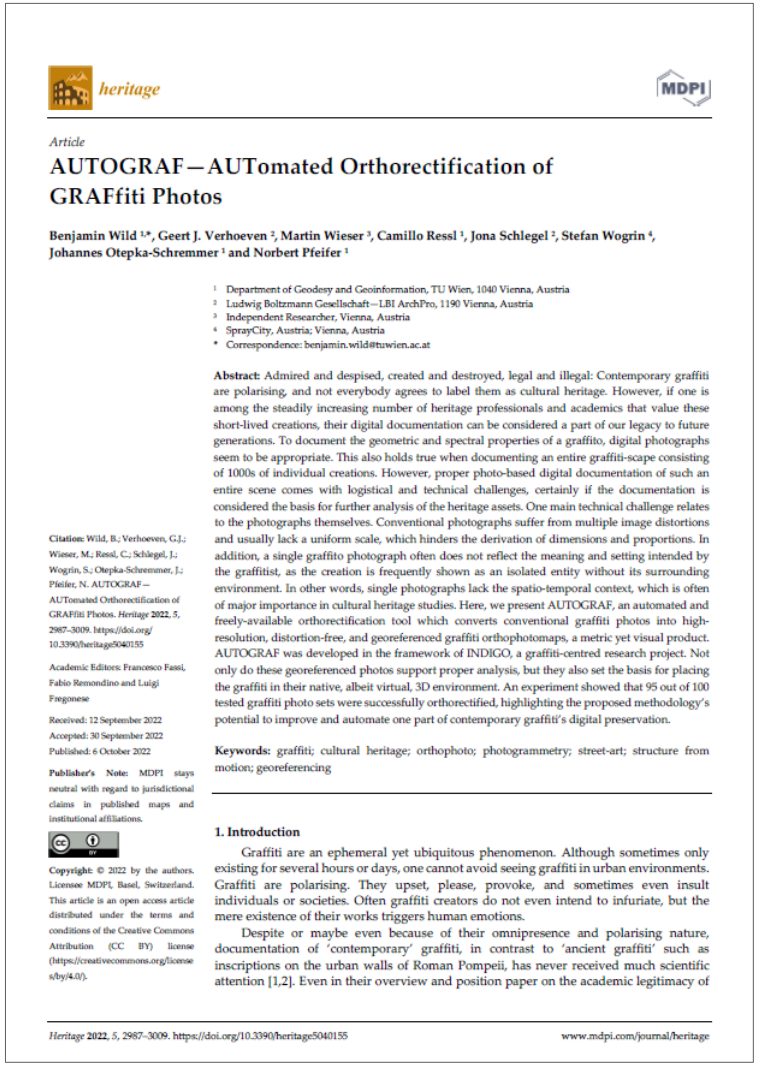
3

HARDWARE

1

DISSEMINATION scientific audience

Heritage *[open-access]*



heritage

MDPI

Article

AUTOGRAF—AUTomated Orthorectification of GRAFfiti Photos

Benjamin Wild [1,*], Geert J. Verhoeven [2], Martin Wieser [3], Camillo Ressl [1], Jona Schlegel [2], Stefan Wogrin [4], Johannes Otepka-Schremmer [1] and Norbert Pfeifer [1]

[1] Department of Geodesy and Geoinformation, TU Wien, 1040 Vienna, Austria
[2] Ludwig Boltzmann Gesellschaft—LBI ArchPro, 1190 Vienna, Austria
[3] Independent Researcher, Vienna, Austria
[4] SprayCity, Austria; Vienna, Austria
* Correspondence: benjamin.wild@tuwien.ac.at

Abstract: Admired and despised, created and destroyed, legal and illegal: Contemporary graffiti are polarising, and not everybody agrees to label them as cultural heritage. However, if one is among the steadily increasing number of heritage professionals and academics that value these short-lived creations, their digital documentation can be considered a part of our legacy to future generations. To document the geometric and spectral properties of a graffito, digital photographs seem to be appropriate. This also holds true when documenting an entire graffiti-scape consisting of 1000s of individual creations. However, proper photo-based digital documentation of such an entire scene comes with logistical and technical challenges, certainly if the documentation is considered the basis for further analysis of the heritage assets. One main technical challenge relates to the photographs themselves. Conventional photographs suffer from multiple image distortions and usually lack a uniform scale, which hinders the derivation of dimensions and proportions. In addition, a single graffito photograph often does not reflect the meaning and setting intended by the graffitist, as the creation is frequently shown as an isolated entity without its surrounding environment. In other words, single photographs lack the spatio-temporal context, which is often of major importance in cultural heritage studies. Here, we present AUTOGRAF, an automated and freely-available orthorectification tool which converts conventional graffiti photos into high-resolution, distortion-free, and georeferenced graffiti orthophotomaps, a metric yet visual product. AUTOGRAF was developed in the framework of INDIGO, a graffiti-centred research project. Not only do these georeferenced photos support proper analysis, but they also set the basis for placing the graffiti in their native, albeit virtual, 3D environment. An experiment showed that 95 out of 100 tested graffiti photo sets were successfully orthorectified, highlighting the proposed methodology's potential to improve and automate one part of contemporary graffiti's digital preservation.

Keywords: graffiti; cultural heritage; orthophoto; photogrammetry; street-art; structure from motion; georeferencing

Citation: Wild, B.; Verhoeven, G.J.; Wieser, M.; Ressl, C.; Schlegel, J.; Wogrin, S.; Otepka-Schremmer, J.; Pfeifer, N. AUTOGRAF—AUTomated Orthorectification of GRAFfiti Photos. *Heritage* **2022**, *5*, 2987–3009. https://doi.org/10.3390/heritage5040155

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1. Introduction

Graffiti are an ephemeral yet ubiquitous phenomenon. Although sometimes only existing for several hours or days, one cannot avoid seeing graffiti in urban environments. Graffiti are polarising. They upset, please, provoke, and sometimes even insult individuals or societies. Often graffiti creators do not even intend to infuriate, but the mere existence of their works triggers human emotions.

Despite or maybe even because of their omnipresence and polarising nature, documentation of 'contemporary' graffiti, in contrast to 'ancient graffiti' such as inscriptions on the urban walls of Roman Pompeii, has never received much scientific attention [1,2]. Even in their overview and position paper on the academic legitimacy of

SOFTWARE

3

ARTICLES

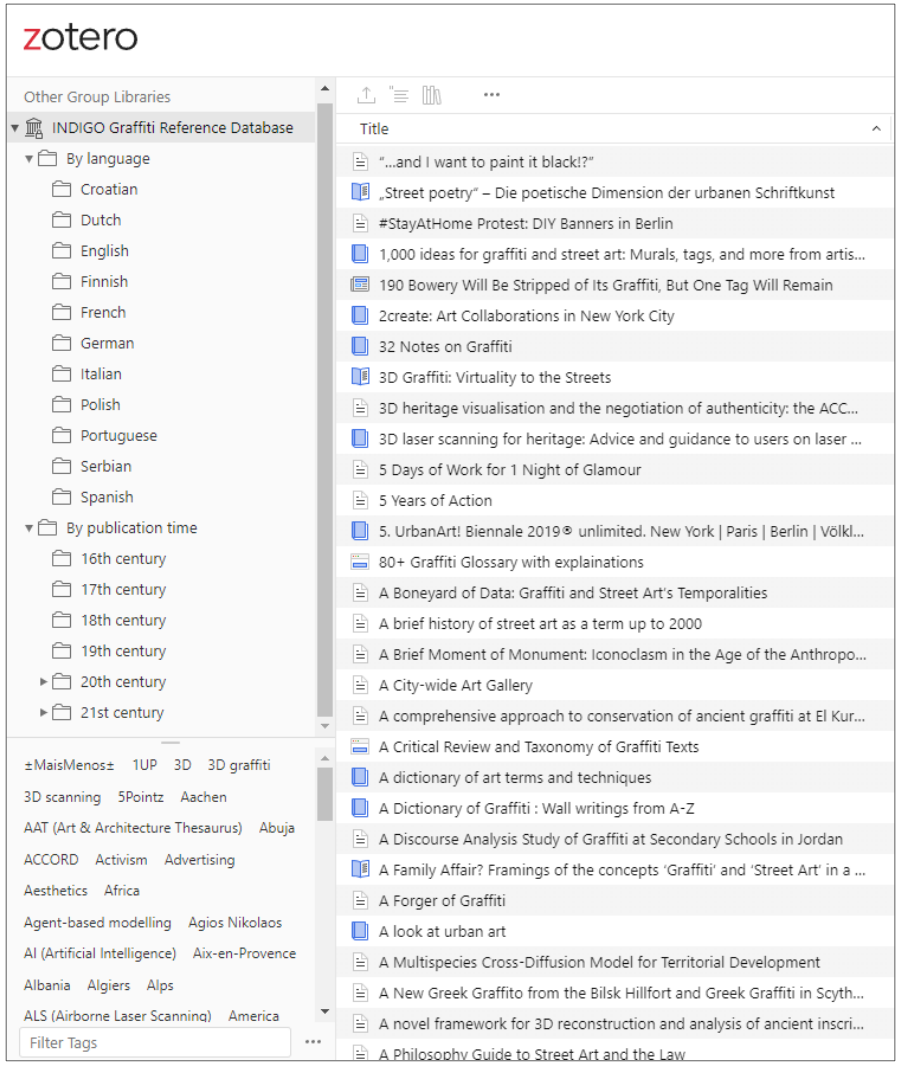
5+9 (+6)

HARDWARE

1

DISSEMINATION scientific audience

Graffiti literature database



SOFTWARE

3

ARTICLES

5+9 (+6)

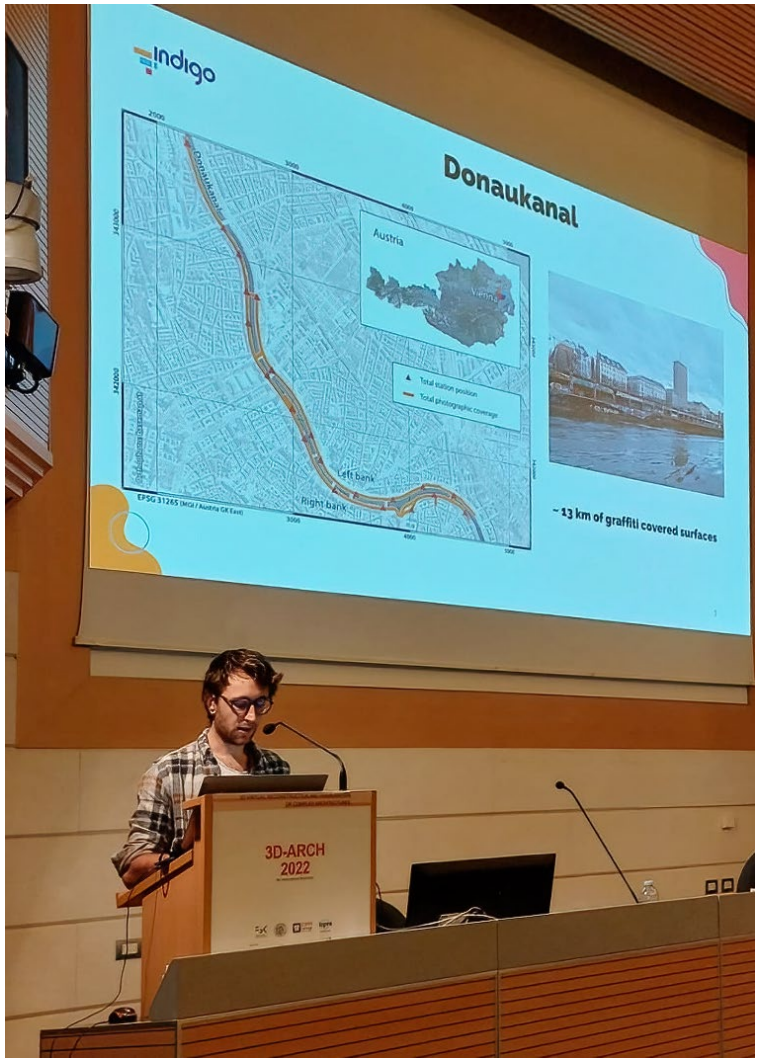
HARDWARE

1

DATA SETS

5 (+1)

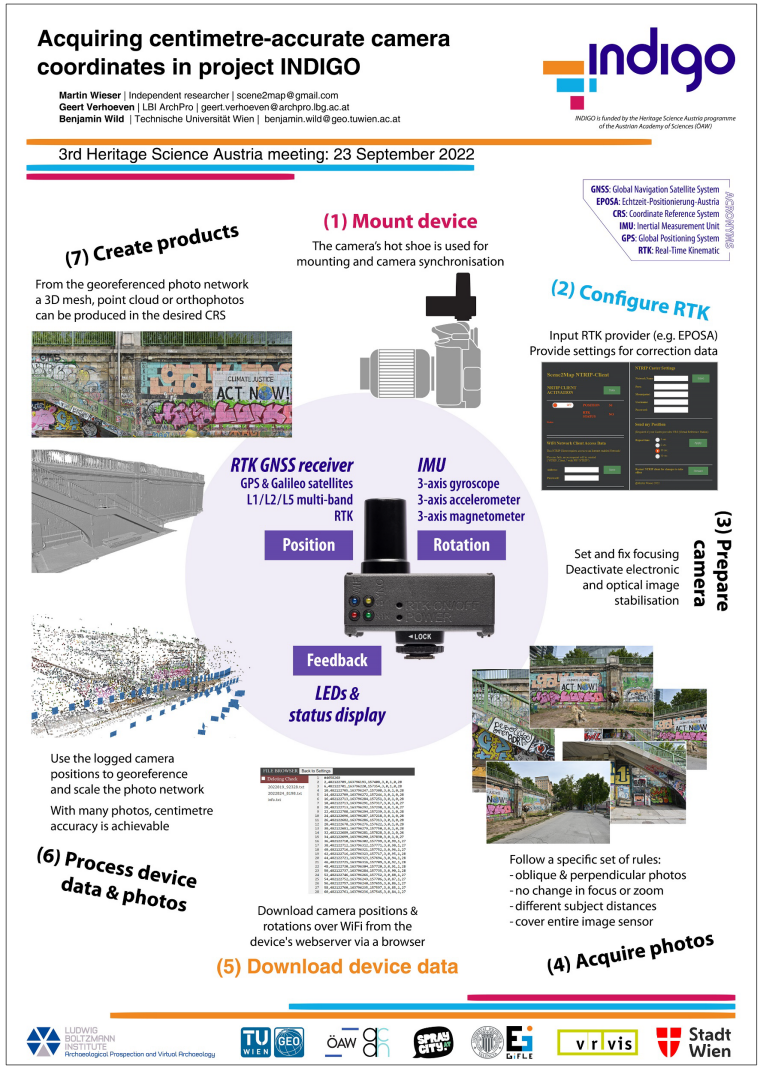
DISSEMINATION scientific audience



TALKS

24

DISSEMINATION scientific audience



TALKS

24

POSTERS

3

DISSEMINATION scientific audience

TALKS

24

SYMPOSIA

2

POSTERS

3

DISSEMINATION scientific audience

TALKS
24

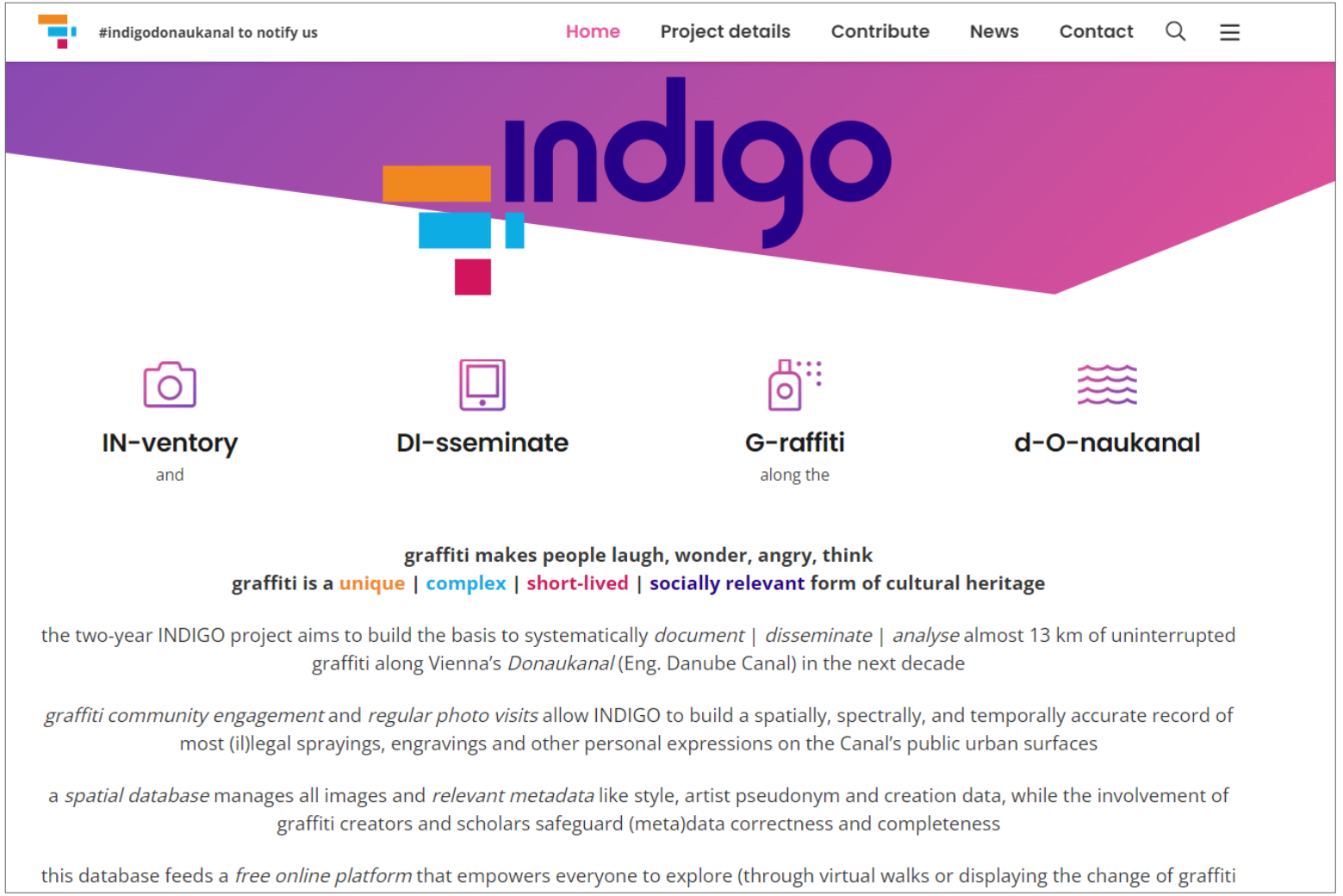
SYMPOSIA
2

POSTERS
3

EDITED VOLUME
1 (+1)

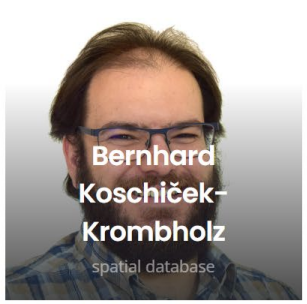
INDIGO website

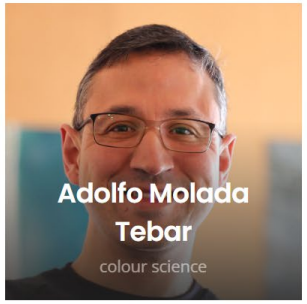
https://projectindigo.eu

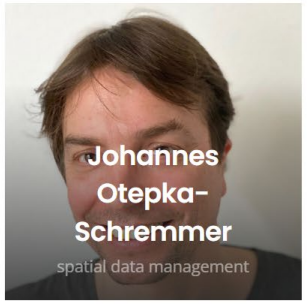


INDIGO team

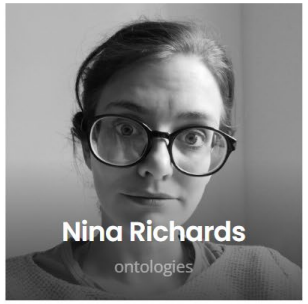
Geert Verhoeven

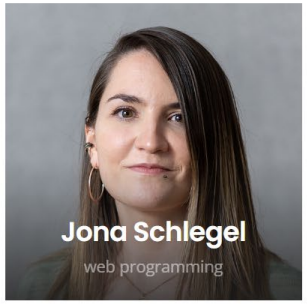




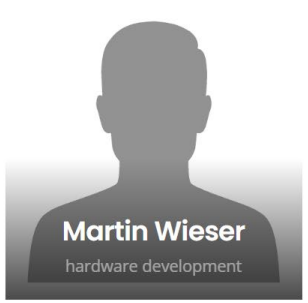


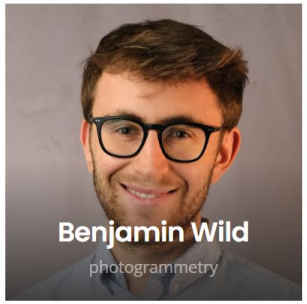
Norbert Pfeifer





Stefan Wogrin





Digital Graffiti-scape Archaeology