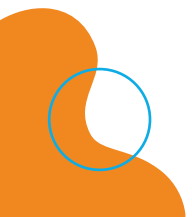




# indigo

Geert Verhoeven | *project leader*  
[projectindigo.eu](http://projectindigo.eu)



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





# **GRAFFITI**

## **socio-cultural heritage**

iconic

ТОЙ СМЕРТНОЙ  
MIR, DIESE TÖDLICHE LIEBE ZW





# **GRAFFITI**

## **socio-cultural heritage**

**iconic**





multi-  
faceted

# GRAFFITI

## socio-cultural heritage

art <> vandalism

graphical <> textual

socio-political criticism <> entertaining

legal <> illegal

tangible <> intangible





# **GRAFFITI**

## **socio-cultural heritage**

art <> vandalism

graphical <> textual

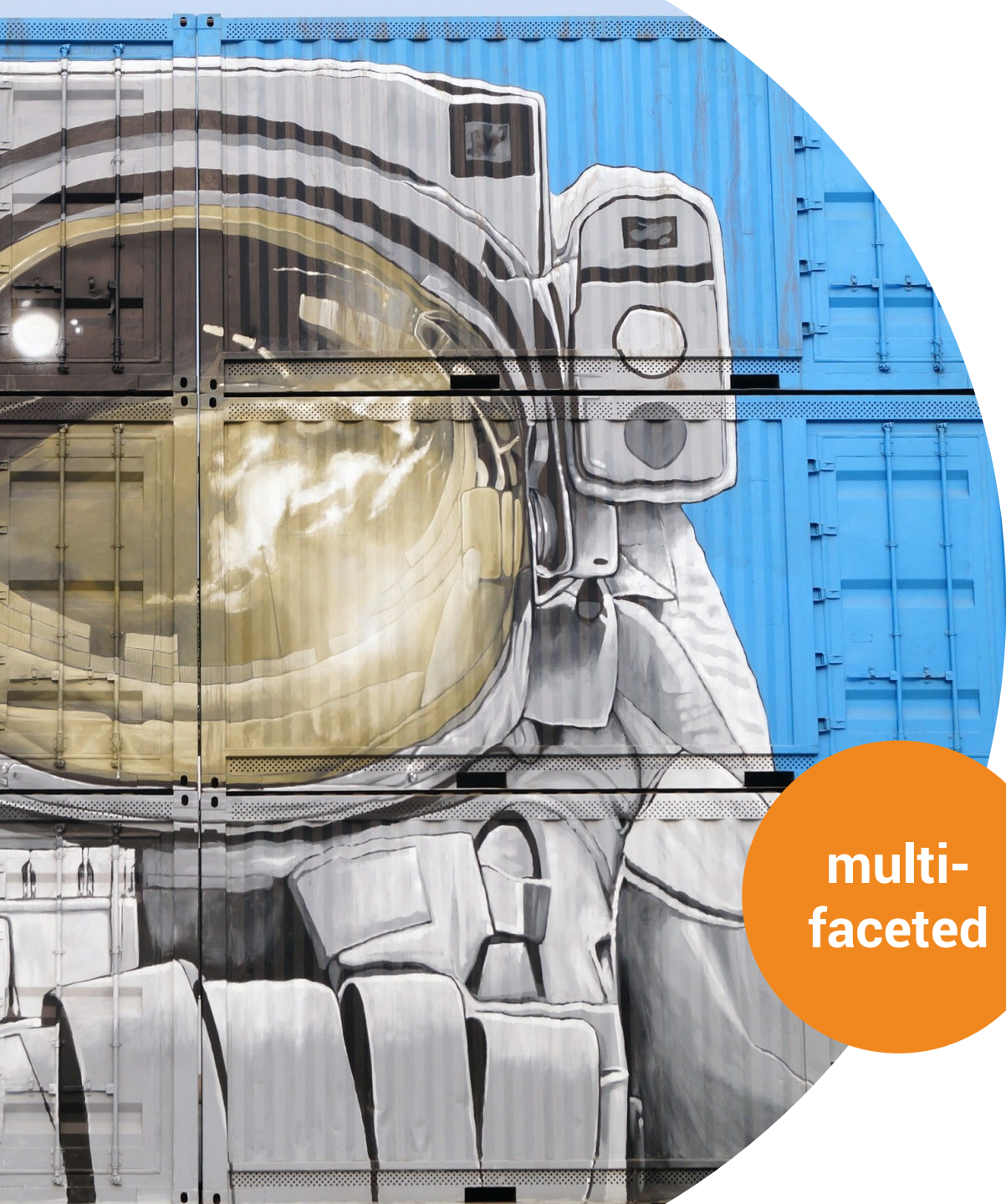
socio-political criticism <> entertaining

legal <> illegal

tangible <> intangible

**multi-  
faceted**





multi-  
faceted

# GRAFFITI

## socio-cultural heritage

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faceted

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faceted**

# **GRAFFITI**

## **socio-cultural heritage**

art <> vandalism

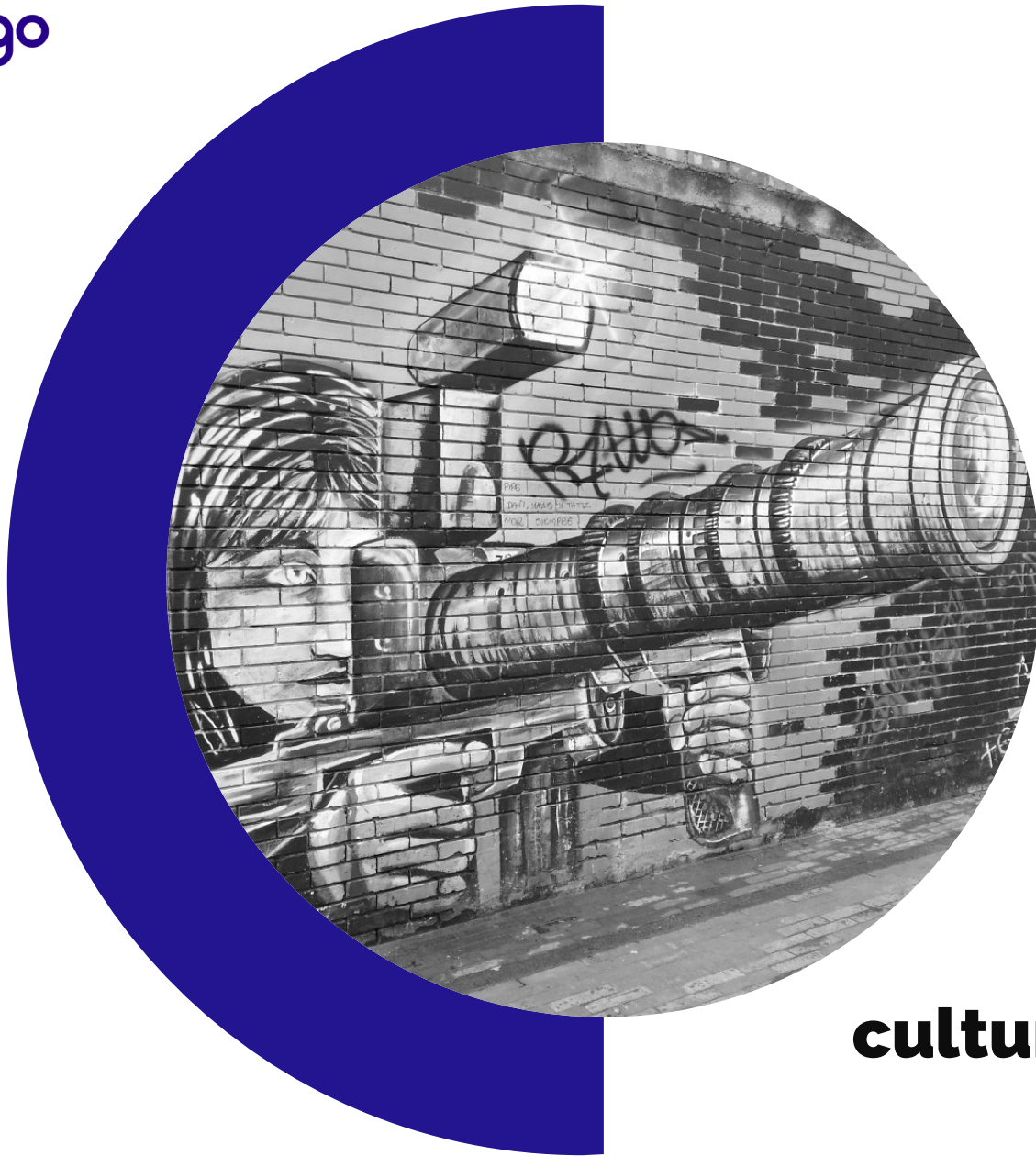
graphical <> textual

socio-political criticism <> entertaining

legal <> illegal

tangible <> intangible





**graffiti is**

**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*







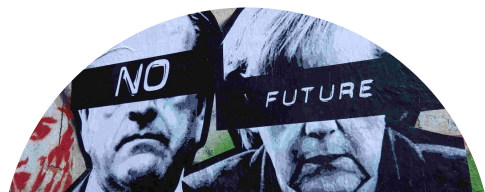
## RECORDING

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

*“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

## ANALYSIS

descriptive  
fragmentary  
biased

# 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

## 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**





in  
di  
go



**In**ventory and  
**d**isseminate  
**g**raffiti along the  
**d** **O** naukanal



**In**ventory and  
**d**isseminate  
**g**raffiti along the  
**d**o naukanal

WHAT

**I**nventory and  
**d**isseminate **WHAT**  
**G**raffiti along the  
**d**onaukanal **WHERE**



**I**nventory and  
**d**isseminate  
**g**raffiti along the  
**d**oaukanal

WHAT

WHERE

---

digitally preserve  
and  
analyse

WHY

The slide features decorative elements: a pink wavy shape in the top right corner, an orange wavy shape in the bottom left corner, and a thin blue circle in the bottom left corner.

**I**nventory and  
**d**isseminate  
**g**raffiti along the  
**d**onautanal

WHAT

WHERE

digitally preserve  
and  
analyse

WHY

WHO



**I**nventory and  
**d**isseminate  
**g**raffiti along the  
**d**onauskanal

WHAT

WHERE

digitally preserve  
and  
analyse

WHY



WHO

**I**nventory and  
**d**isseminate  
**g**raffiti along the  
**d**igital kanal

WHAT

WHERE

digitally preserve  
and  
analyse

WHY



WHO



**I**nventory and  
**d**isseminate  
**g**raffiti along the  
**d**onauskanal

WHAT

WHERE

digitally preserve  
and  
analyse

WHY



WHO

WHY

Inventory and  
disseminate  
graffiti along the  
and  
digitally preserve  
and  
analyse

WHAT

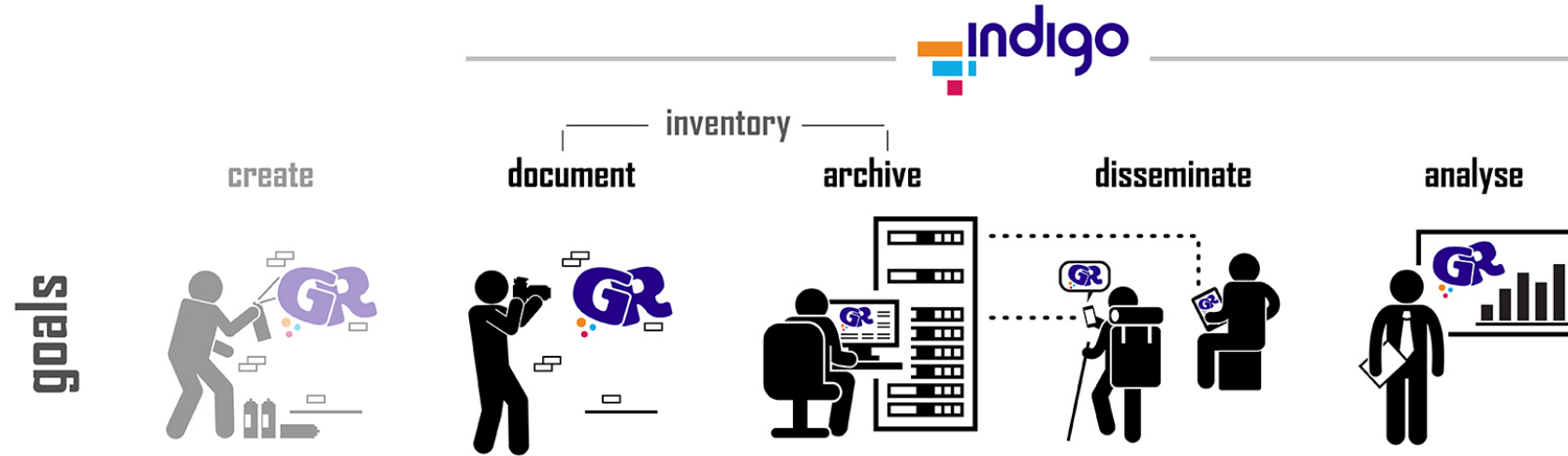
HOW?

WHERE

WHO



# INDIGO approach





# INDIGO approach



goals

create



document



archive



disseminate



analyse



inventory

document

archive

creation



acquisition



processing



management



dissemination



analysis



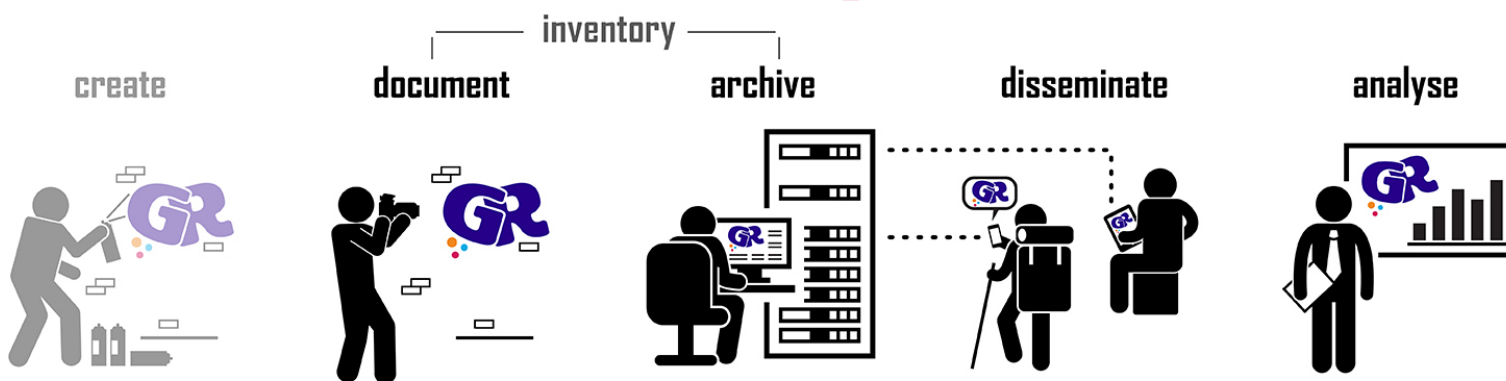
research pillars



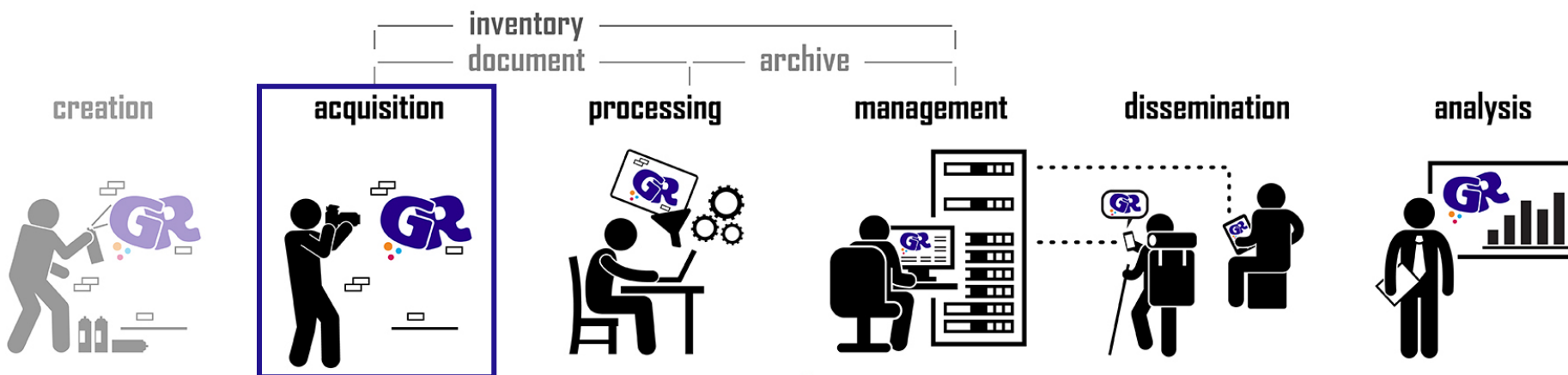
# INDIGO approach



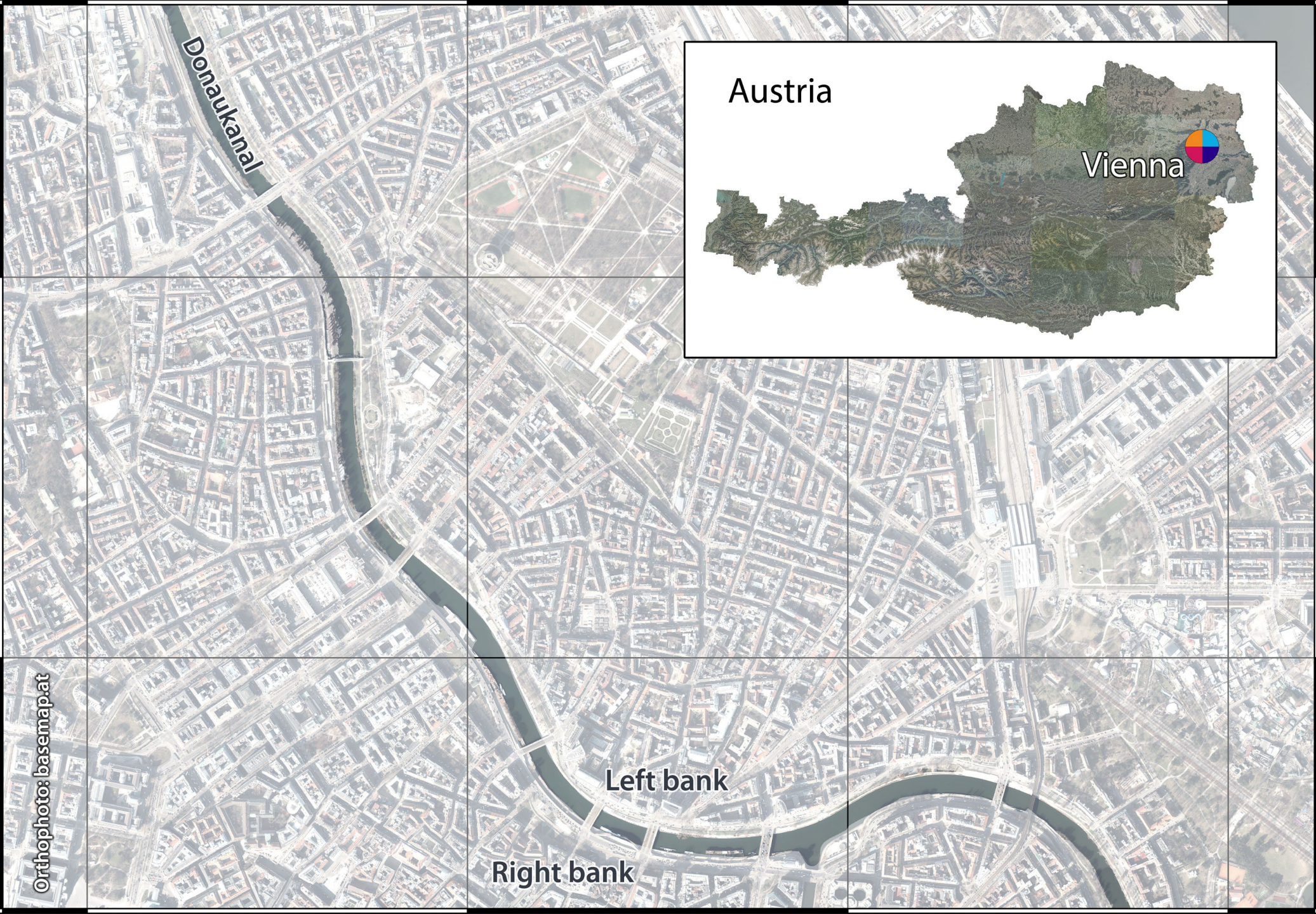
goals



research pillars







Donaukanal

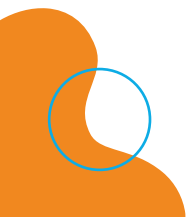
Austria

Vienna

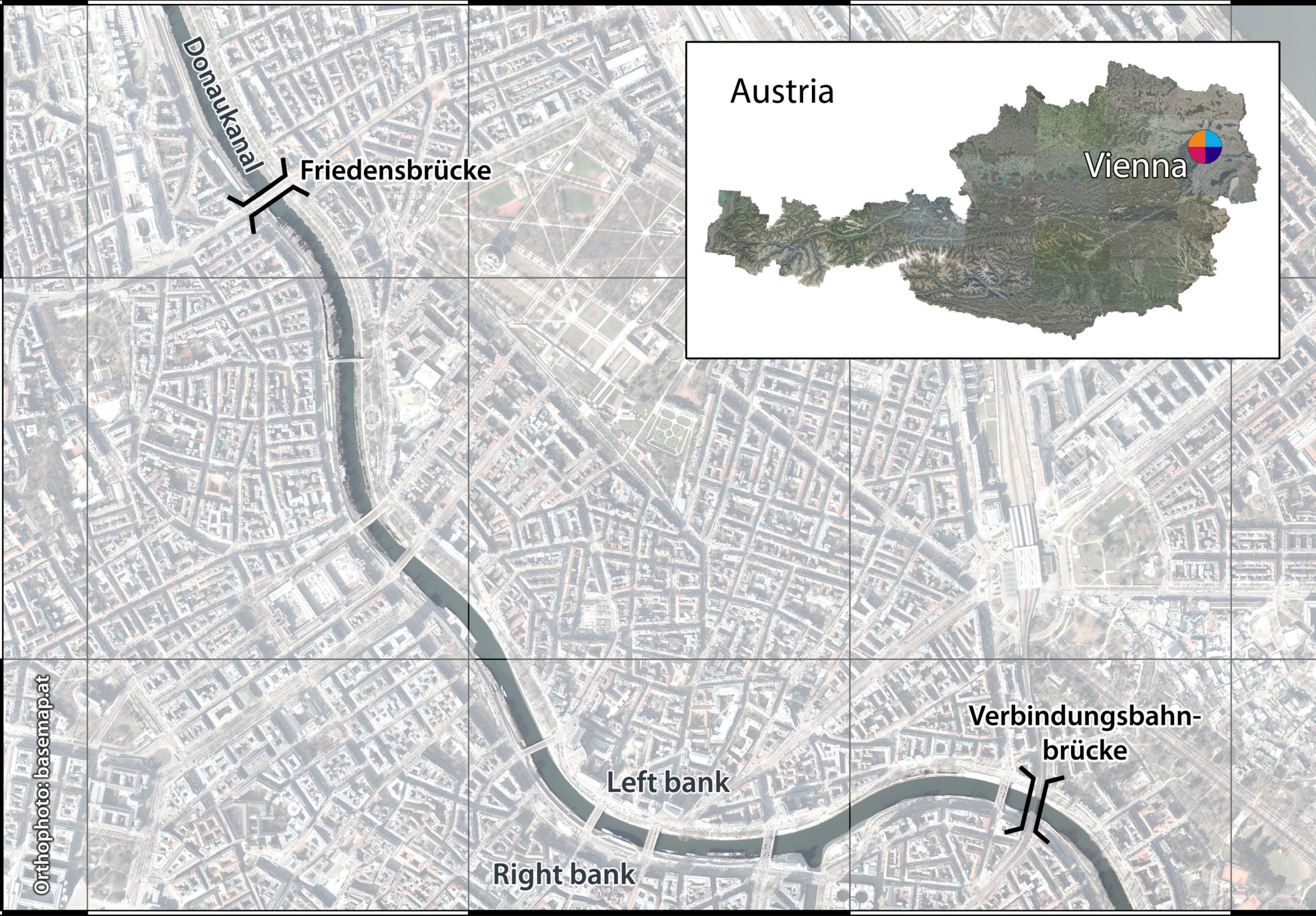
Orthophoto: basemap.at

Left bank

Right bank







Austria

Vienna

Donaukanal

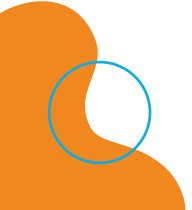
Friedensbrücke

Left bank

Right bank

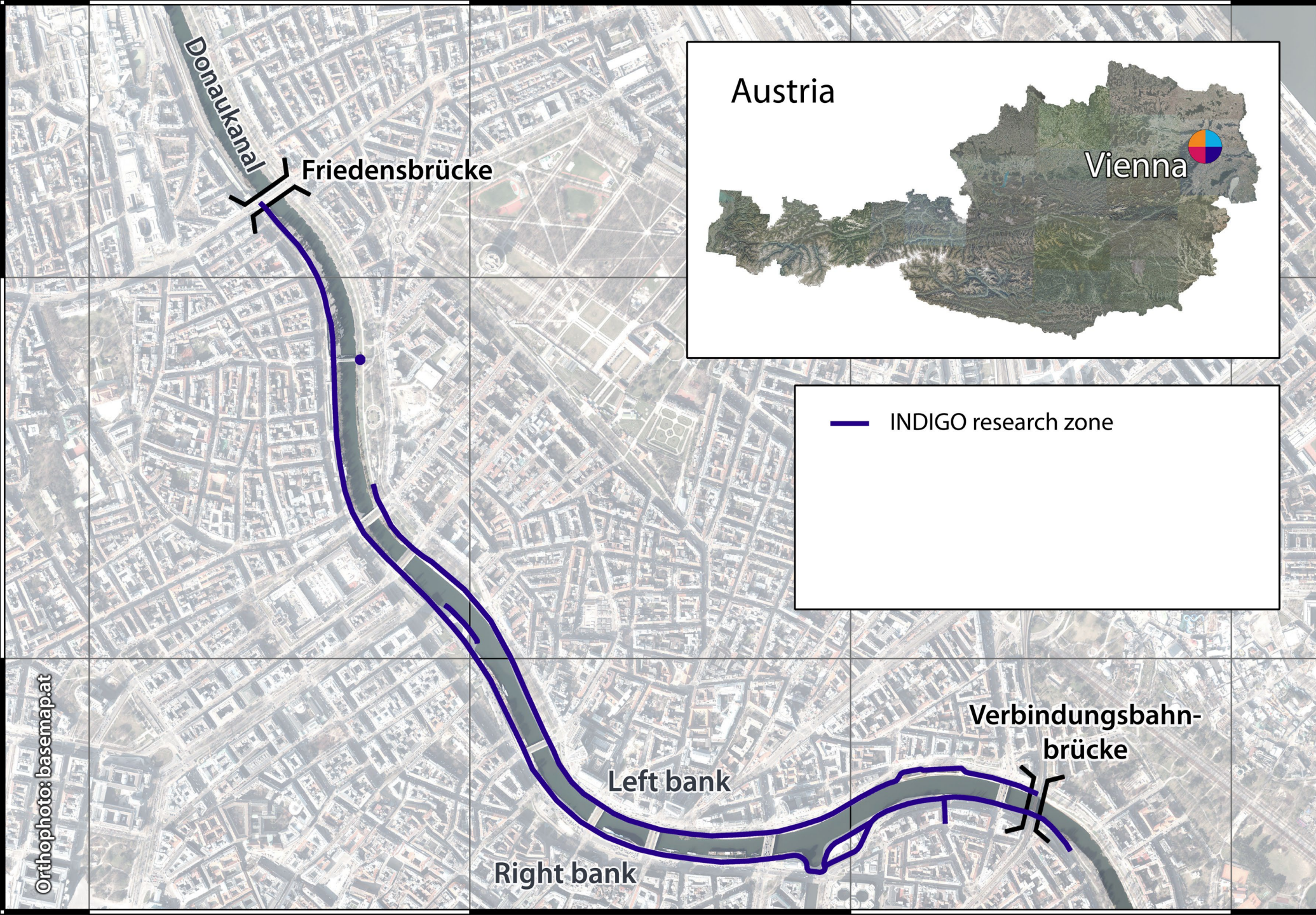
Verbindungsbahnbrücke

Orthophoto: basemap.at





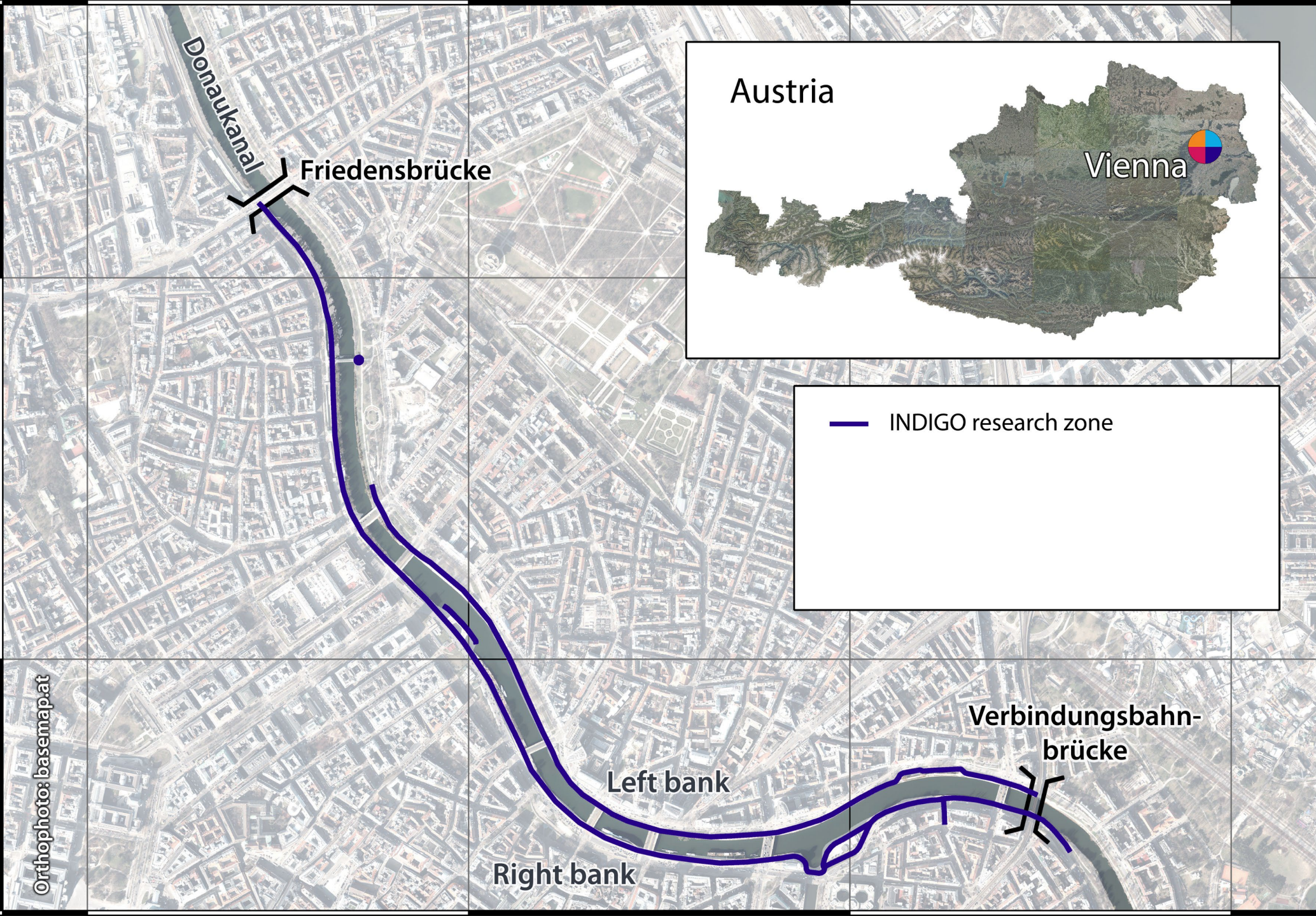
**STRETCH**  
3.3 km





**STRETCH**  
3.3 km

**LEFT    RIGHT**

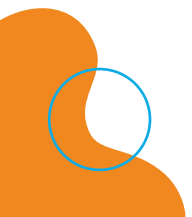




# STRETCH

3.3 km

LEFT    RIGHT

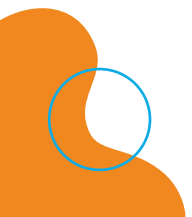




# STRETCH

3.3 km

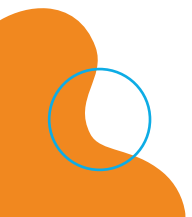
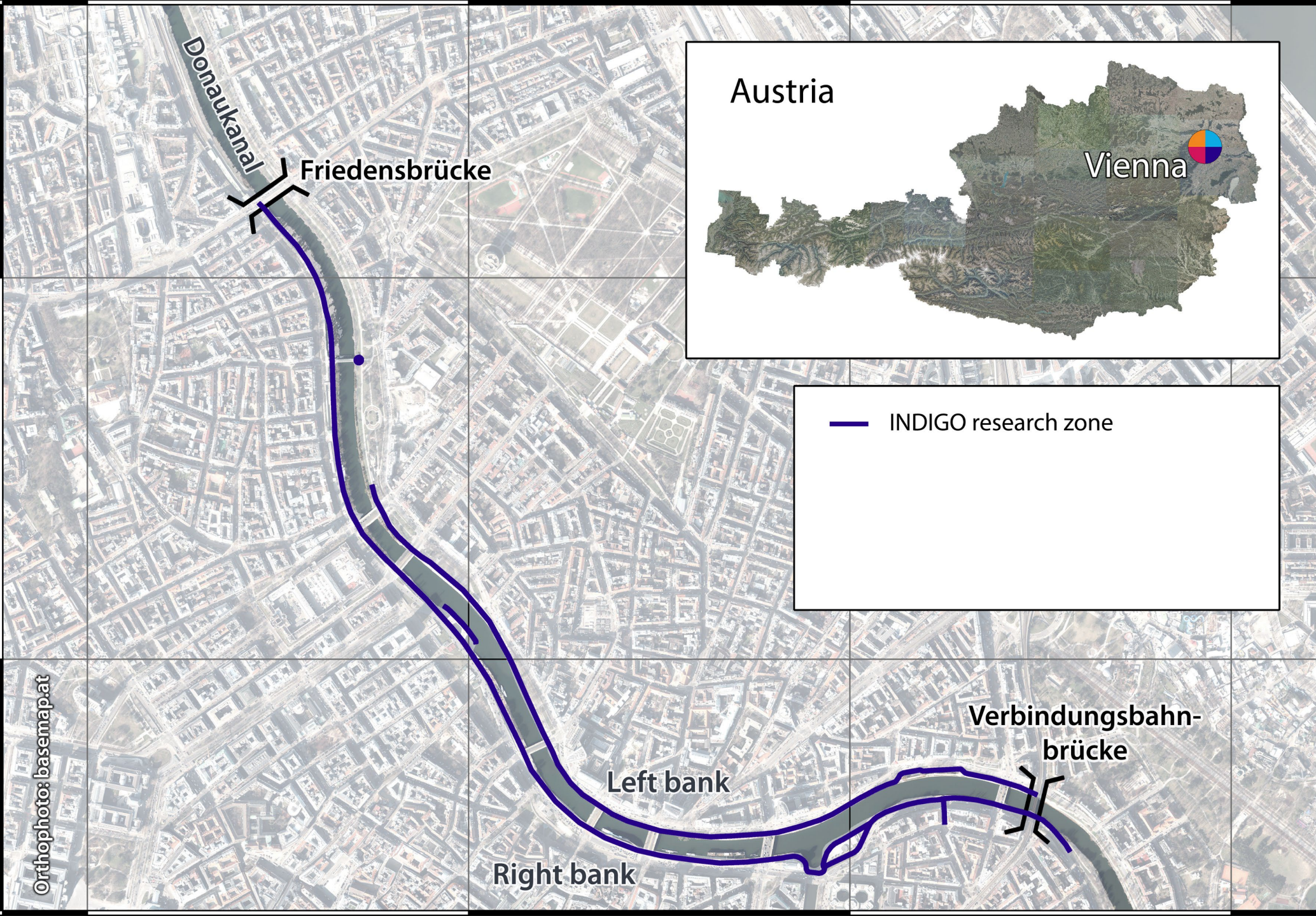
LEFT    RIGHT  
UP      UP  
DOWN   DOWN





**STRETCH**  
3.3 km

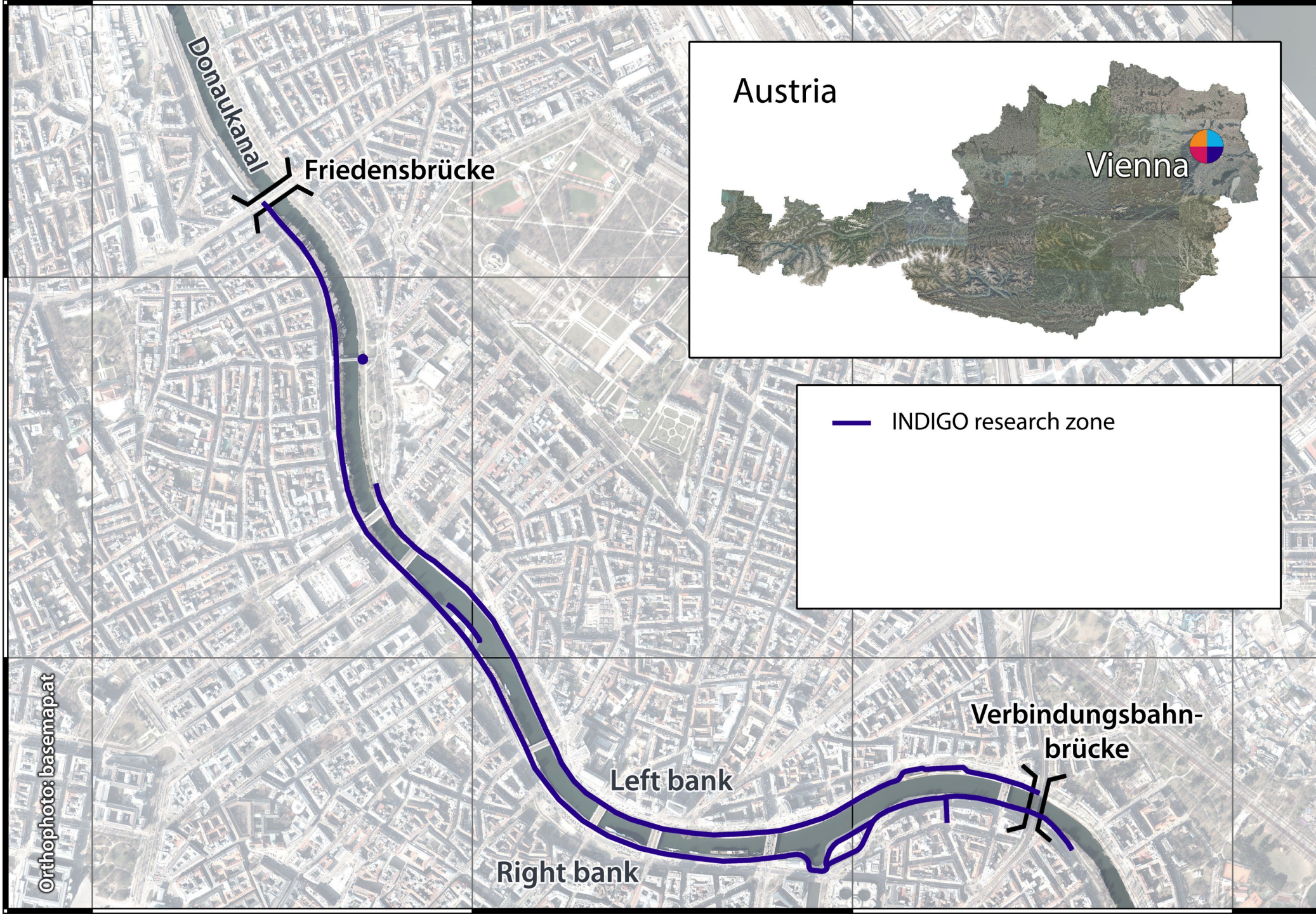
<b>LEFT</b>	<b>RIGHT</b>
UP	UP
3.2 km	5.3 km
DOWN	DOWN





**STRETCH**  
3.3 km

<b>LEFT</b>	<b>RIGHT</b>
UP	UP
3.2 km	5.3 km
<b>DOWN</b>	<b>DOWN</b>
2.1 km	2.3 km





## STRETCH

3.3 km

**LEFT**    **RIGHT**

**UP**      **UP**

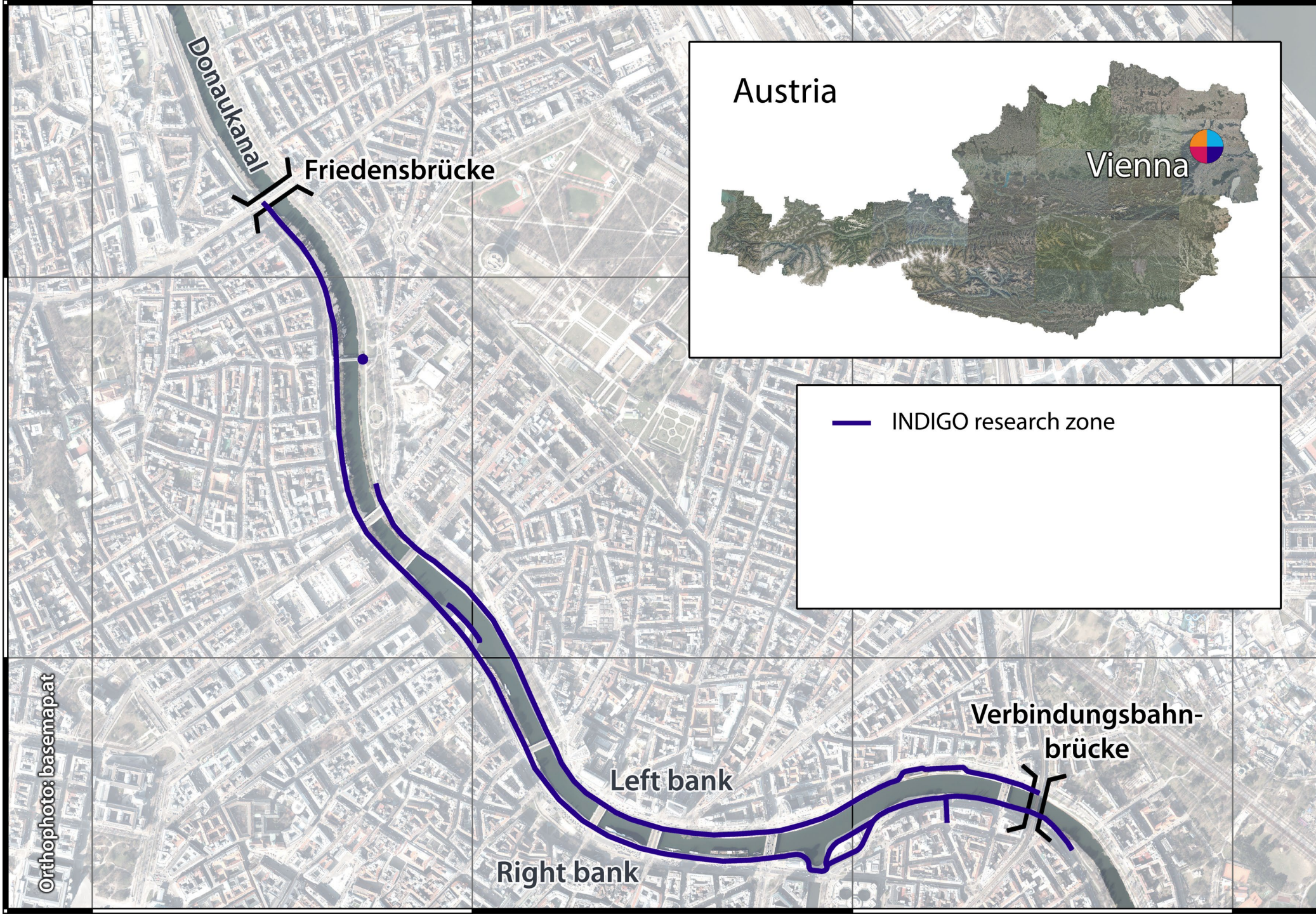
3.2 km    5.3 km

**DOWN**   **DOWN**

2.1 km    2.3 km

## MONITORED SURFACES

12.9 km





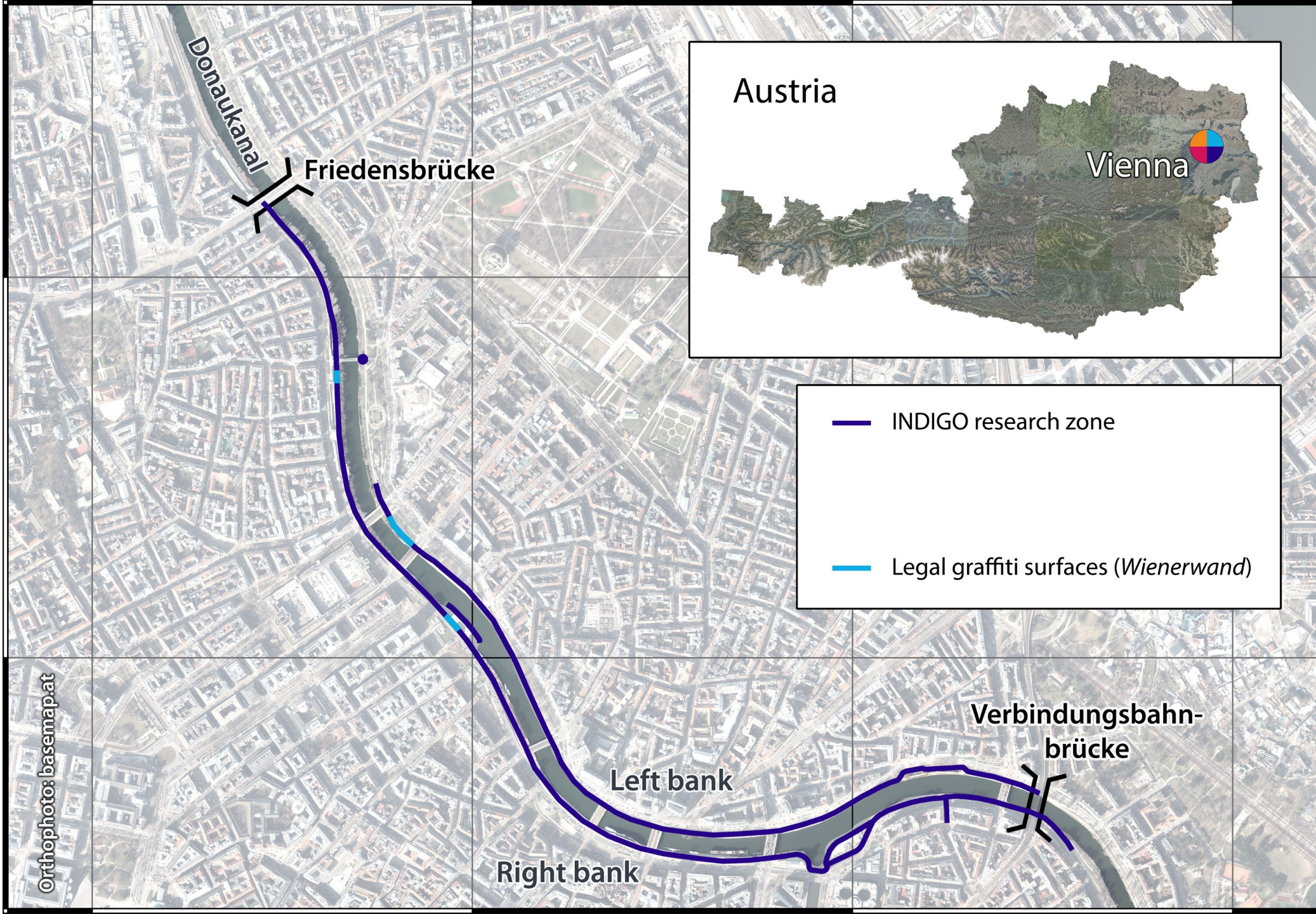
**LEGAL SURFACES**

0.3 km

**MONITORED SURFACES**

12.9 km

Orthophoto: basemap.at



Austria

Vienna

- INDIGO research zone
- Legal graffiti surfaces (*Wienerwand*)

Donaukanal

Friedensbrücke

Left bank

Right bank

Verbindungsbahnbrücke



**TOTAL  
COVERAGE**

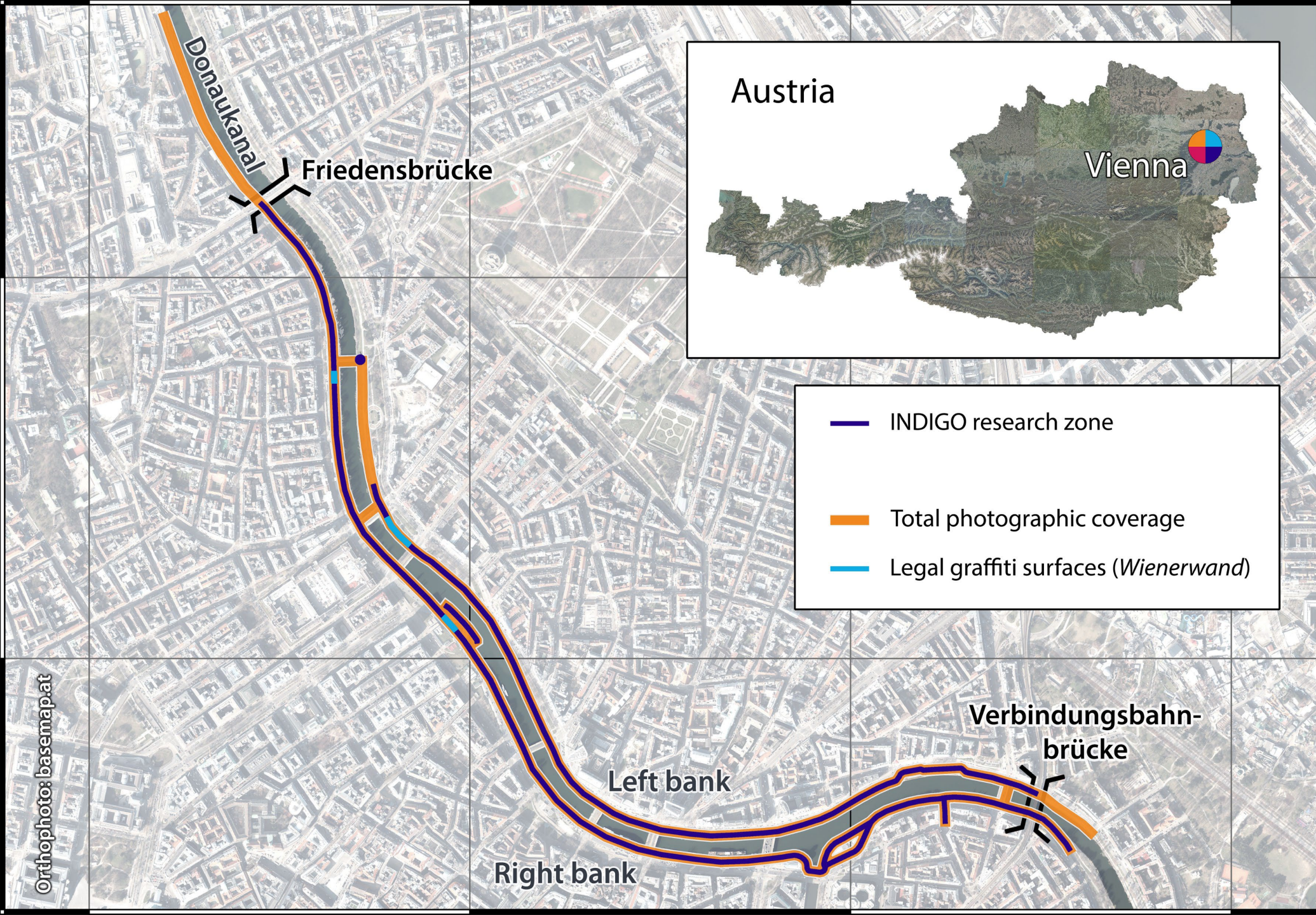
14.0 km

**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

Orthophoto: basemap.at

Donaukanal

Friedensbrücke

Left bank

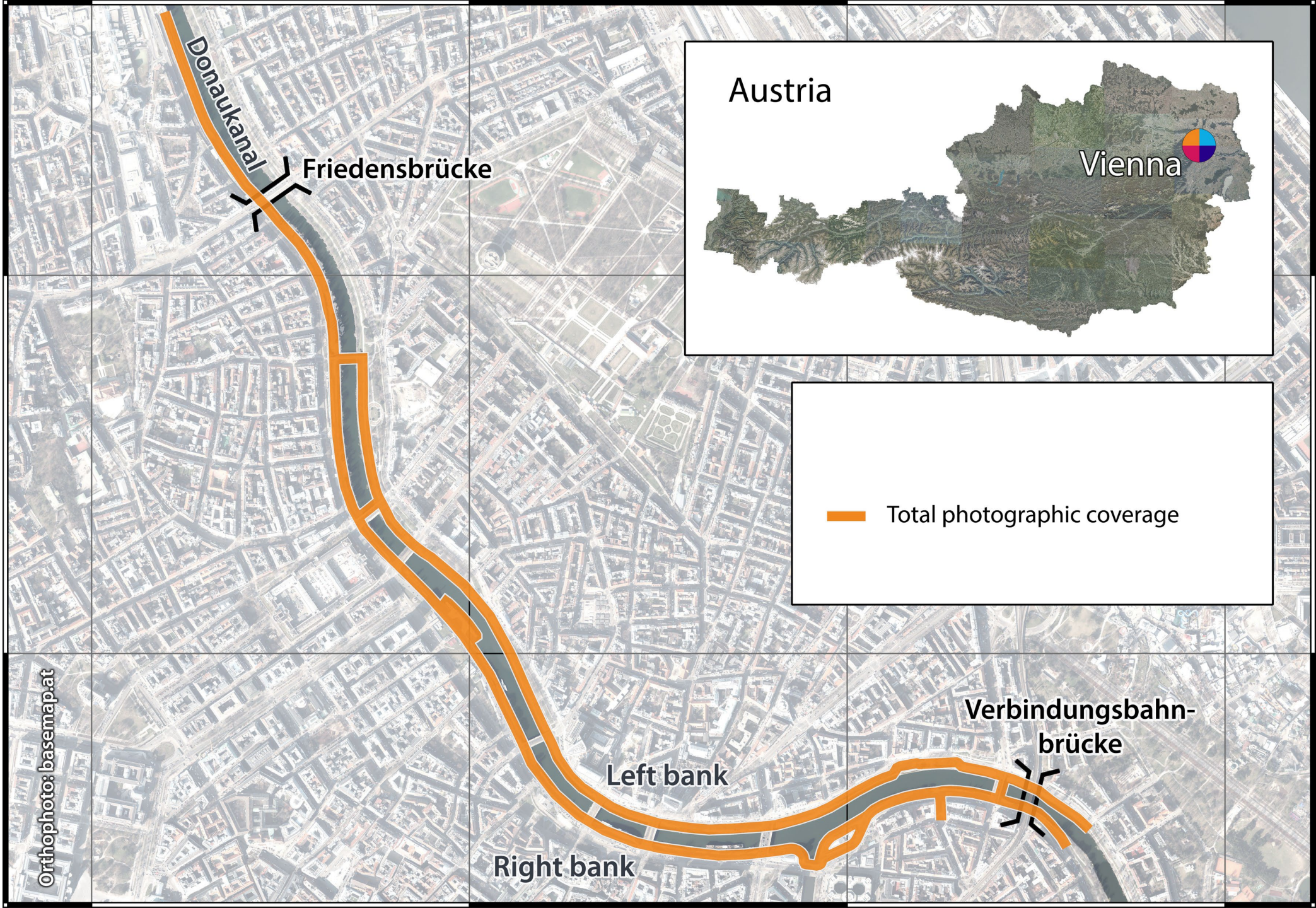
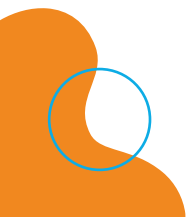
Right bank

Verbindungsbahn-  
brücke

Austria

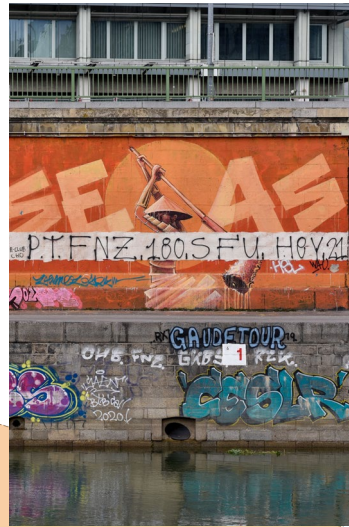
Vienna

— Total photographic coverage





# TOTAL coverage



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





# TOTAL coverage



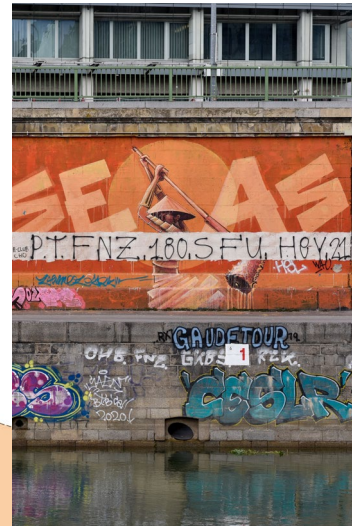
Date	Camera	Lens	Mean GSD	Acquisition time	Image count
------	--------	------	----------	------------------	-------------

26/10/2021				7 h	6042
27/10/2021	Nikon Z 7II (45.4 MP $p = 4.33 \mu\text{m}$ )	Nikon NIKKOR Z 20mm f/1.8 S @ $f/5.6$	0.9 mm	7 h 45 min	6591
28/10/2021				3 h 40 min	2856
29/10/2021				7 h	6608

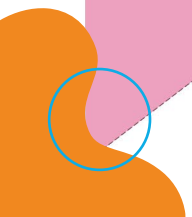




# TOTAL coverage



Date	Camera	Lens	Mean GSD	Acquisition time	Image count
30/09/2021	Nikon D750 (24.2 MP $p = 5.95 \mu\text{m}$ )	Nikon AF-S NIKKOR 85mm 1:1.8 G @ $f/5.6$	3.6 mm	3 h 45 min	2065
01/10/2021				3 h 20 min	2544
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27/10/2021				7 h 45 min	6591
28/10/2021				3 h 40 min	2856
29/10/2021				7 h	6608
<b>Total</b>				<b>32 h 30 min</b>	<b>26706</b>





# TOTAL coverage



Date	Camera	Lens	Mean GSD	Acquisition time	Image count
30/09/2021	Nikon D750 (24.2 MP $p = 5.95 \mu\text{m}$ )	Nikon AF-S NIKKOR 85mm 1:1.8 G @ f/5.6	3.6 mm	3 h 45 min	2065
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27/10/2021				7 h 45 min	6591
28/10/2021				3 h 40 min	2856
29/10/2021				7 h	6608
<b>Total</b>				<b>32 h 30 min</b>	<b>26706</b>



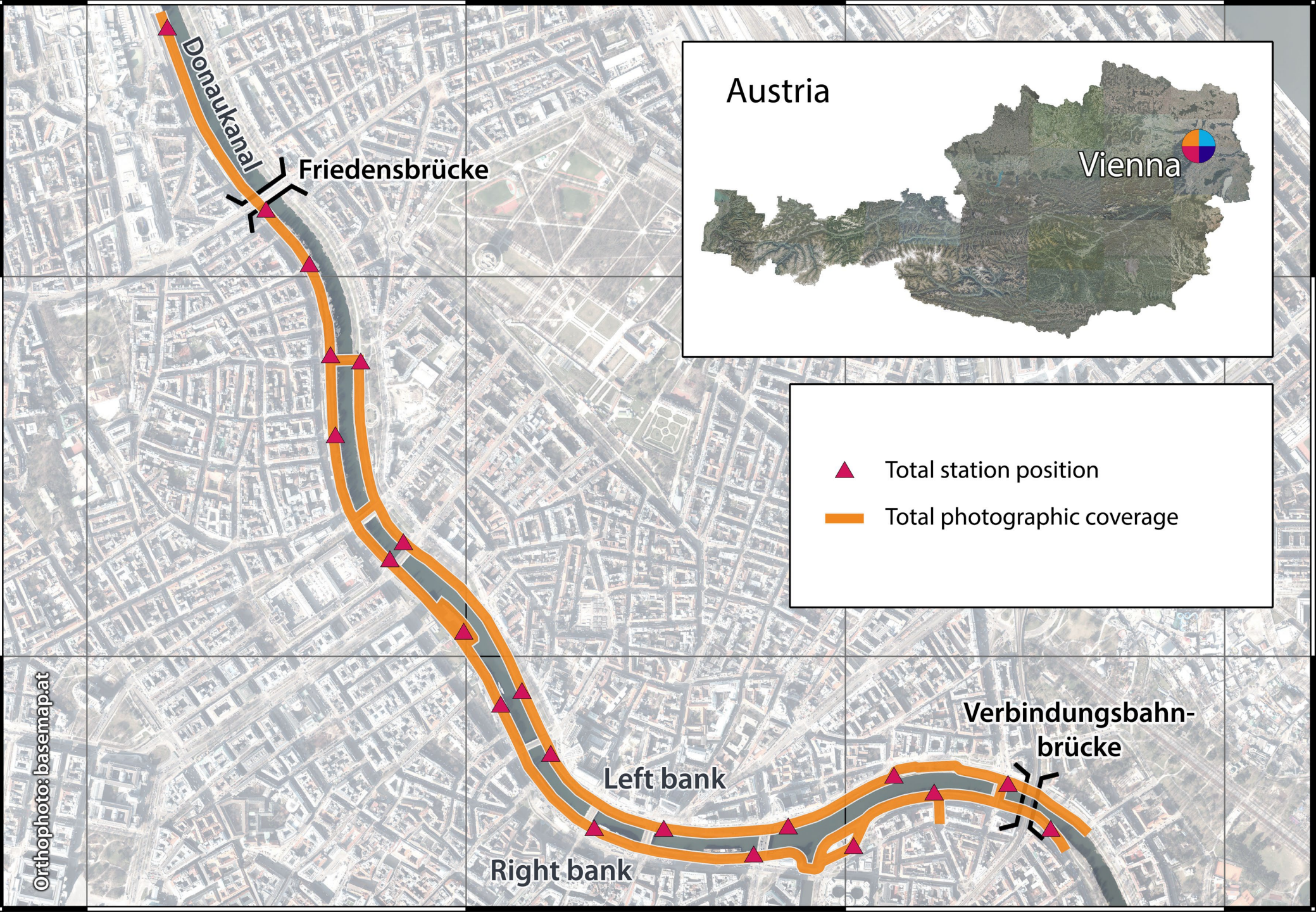


**TOTAL  
COVERAGE**

14.0 km

**TOTAL STATION  
POSITIONS**

21





**TOTAL  
COVERAGE**

14.0 km

**TOTAL STATION  
POSITIONS**

21





**TOTAL  
COVERAGE**

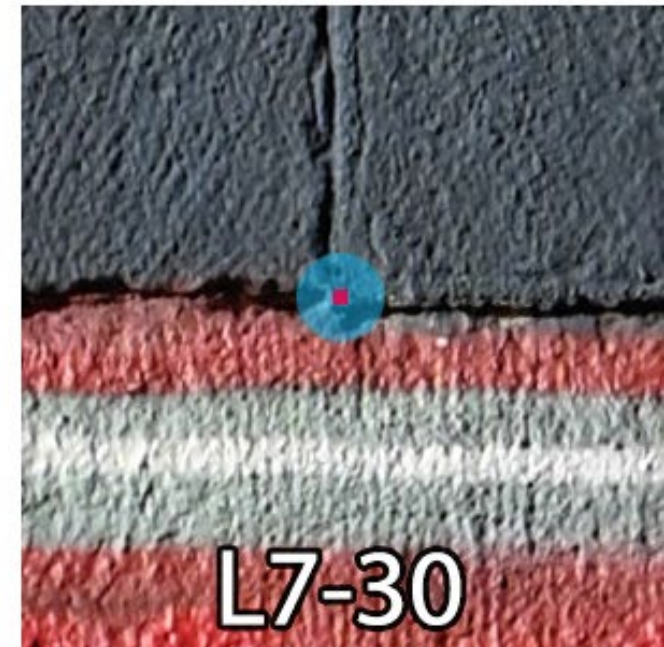
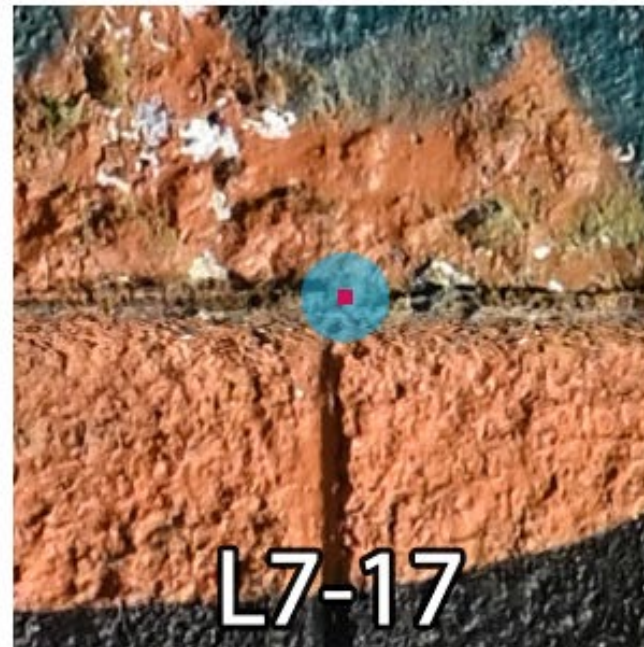
14.0 km

**TOTAL STATION  
POSITIONS**

21

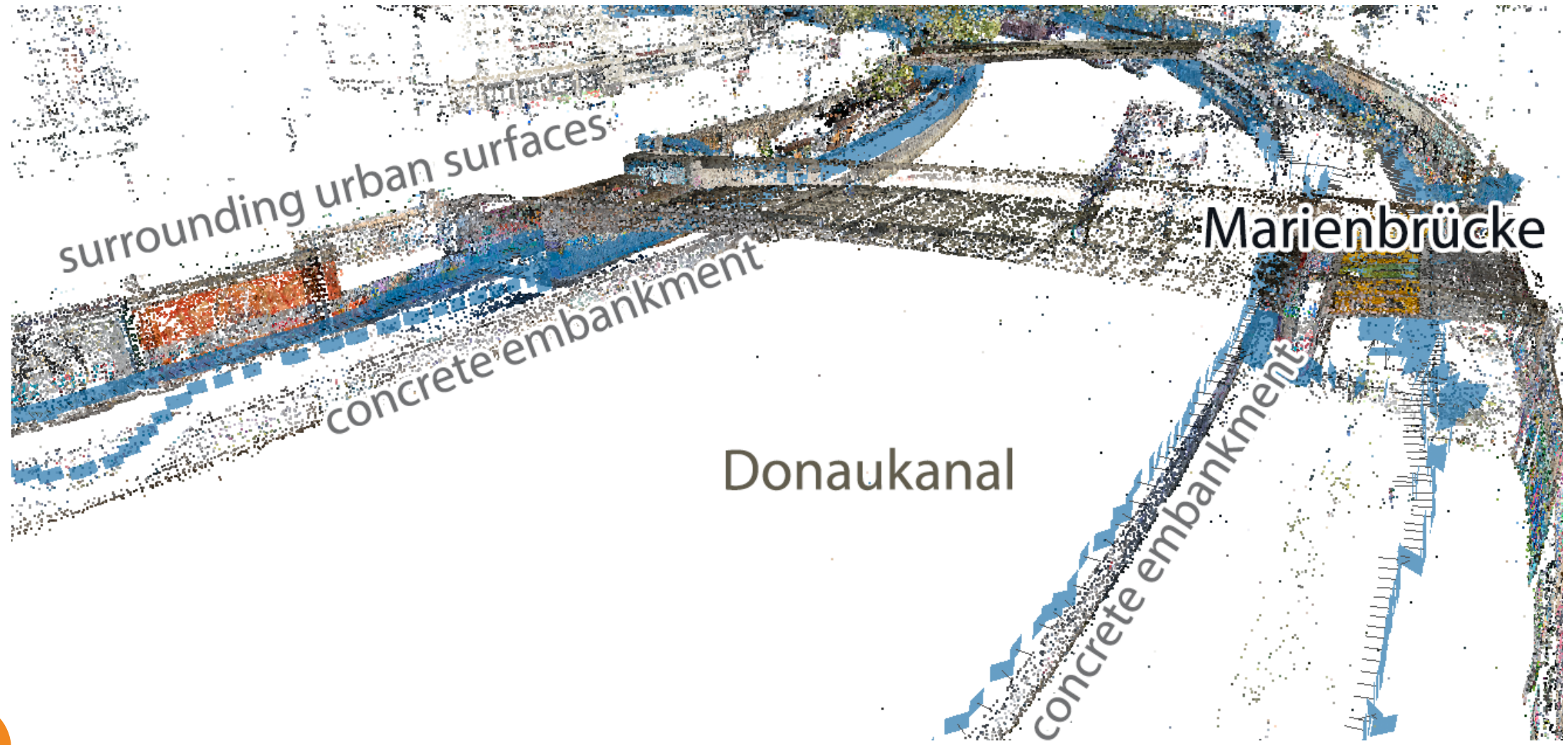
**GRAFFITI-SCAPE  
POINTS**

624



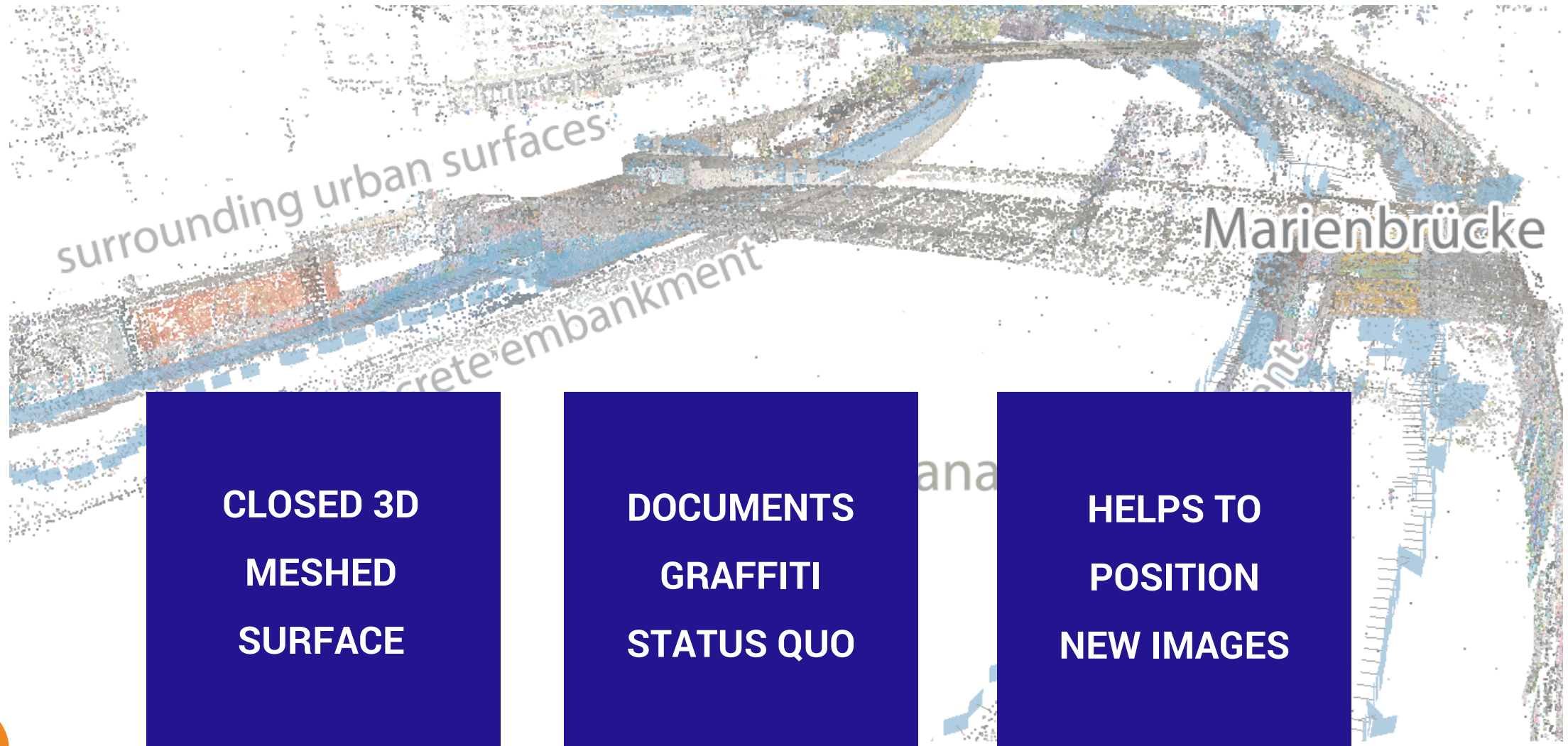


# THREE purposes





# THREE purposes

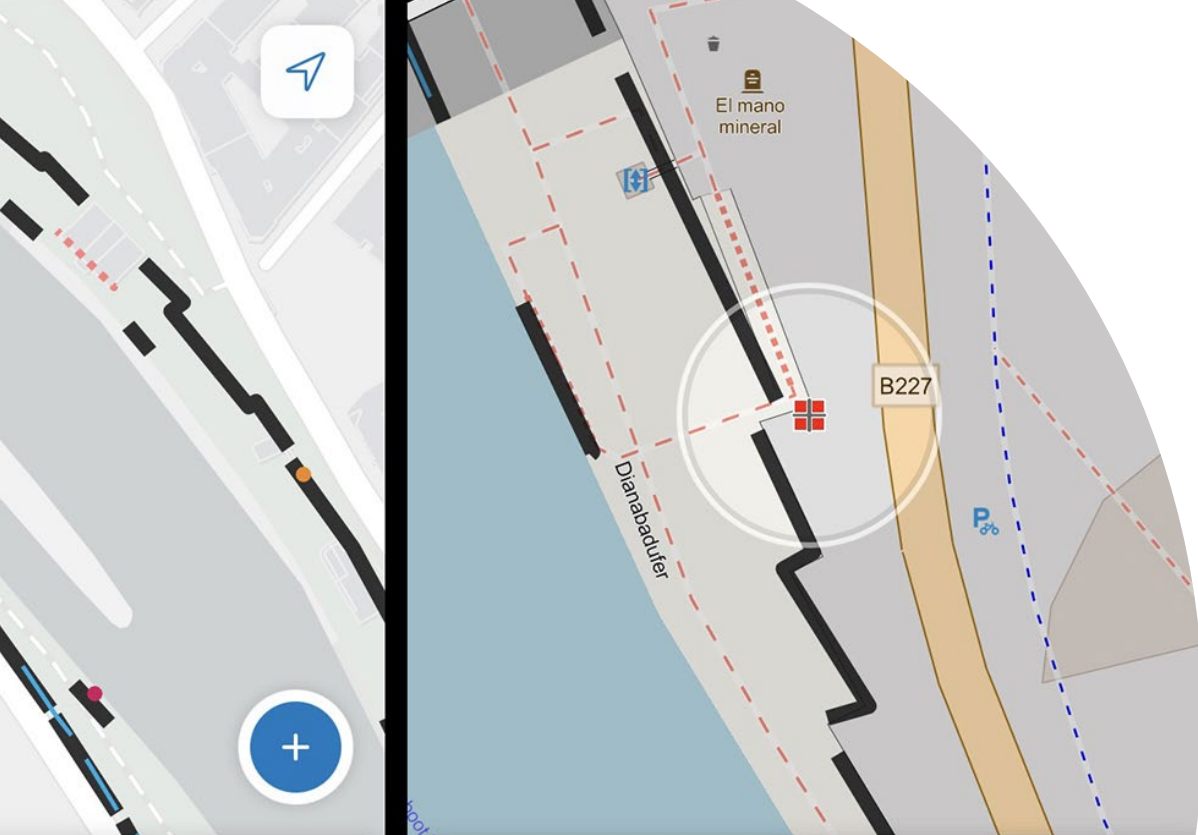


CLOSED 3D  
MESHED  
SURFACE

DOCUMENTS  
GRAFFITI  
STATUS QUO

HELPS TO  
POSITION  
NEW IMAGES





nd, Flex ✕  
5,8 km

Als Anlage

**INDIGO - Monitoring - Graffiti** ⋮

48,214117°N 16,375703°O

**Punkt aktualisieren**

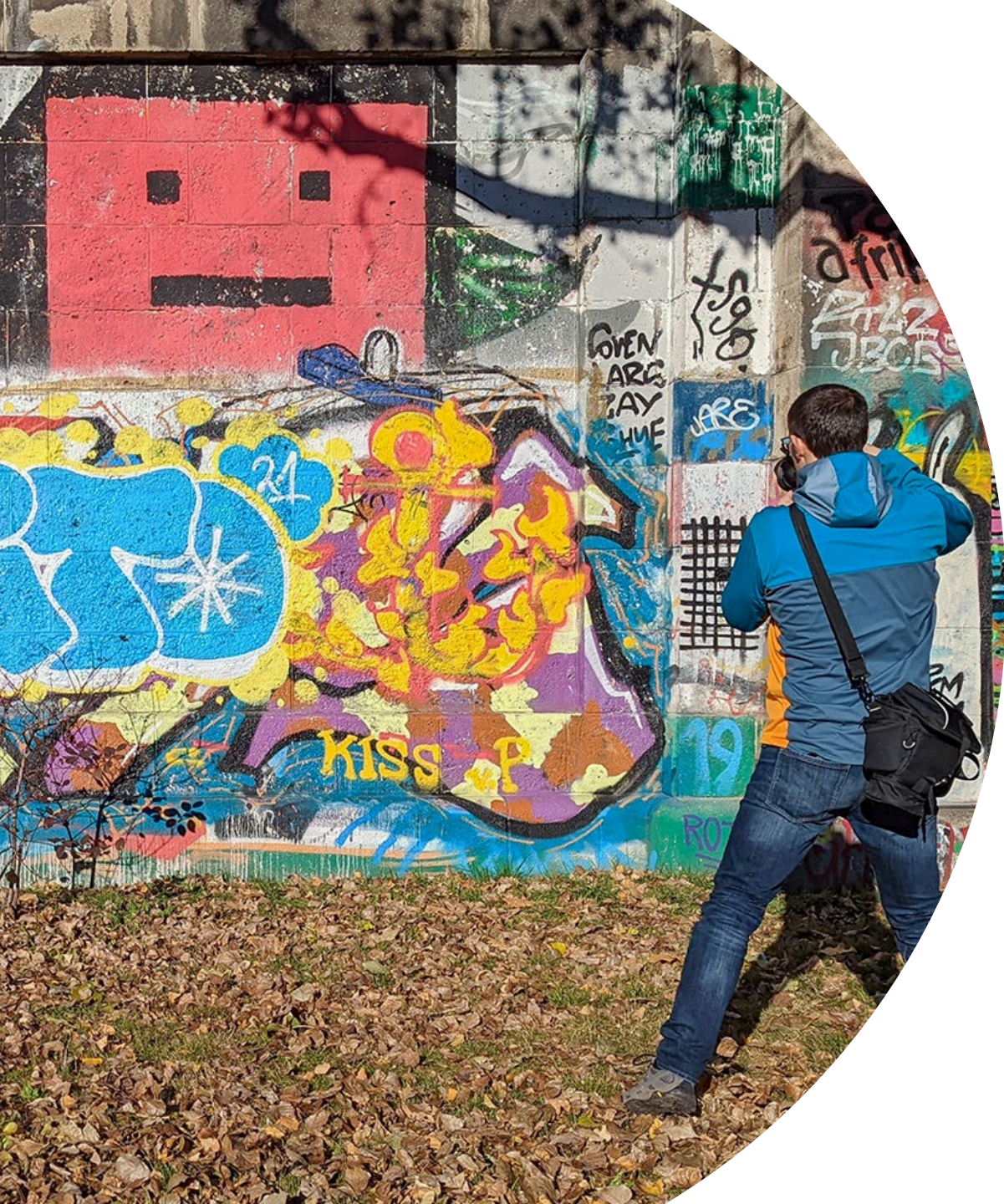
Foto aufnehmen Anfügen

Notes

# 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**



# ACCURATE positioning





# ACCURATE positioning



### Scene2Map NTRIP-Client

**NTRIP CLIENT ACTIVATION** Data

OFF    **POSITION**    3d

**RTK STATUS**    NO

Status

---

### WiFi Network Client Access Data

This NTRIP Client requires access to an Internet enabled Network!

If access fails, an accesspoint will be created ("NTRIP\_Client\_" with PW:"NTRIP")

Address:  Save

Password:

---

### NTRIP Caster Settings

Network Name:  Save

Port:

Mountpoint:

Username:

Password:

---

### Send my Position

(Required if your Caster provides VRS (Virtual Reference Station))

Repeat time:  1 sec.  2 sec.  10 sec.  20 sec. Apply

Restart NTRIP client for changes to take effect Restart

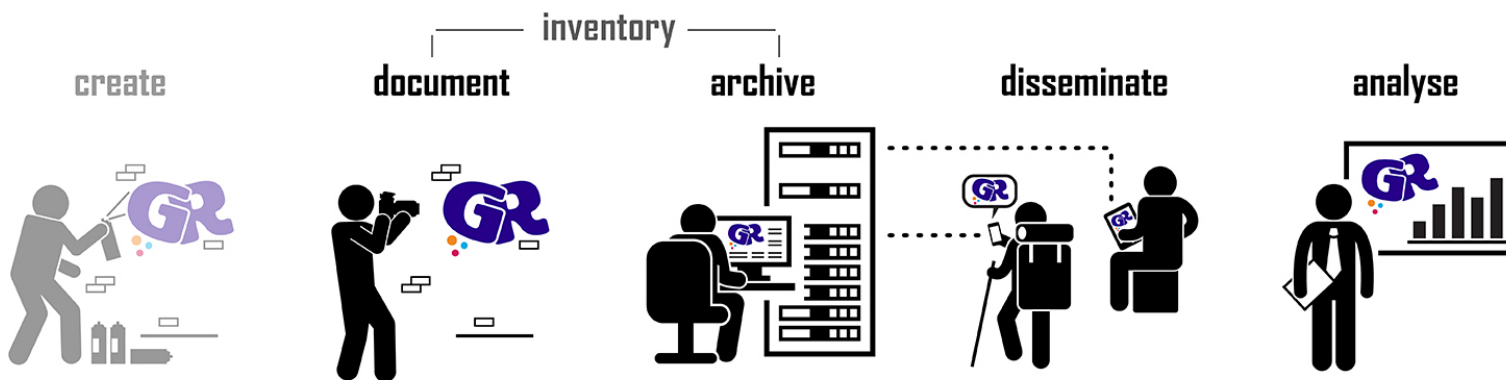
@Martin Wieser 2022



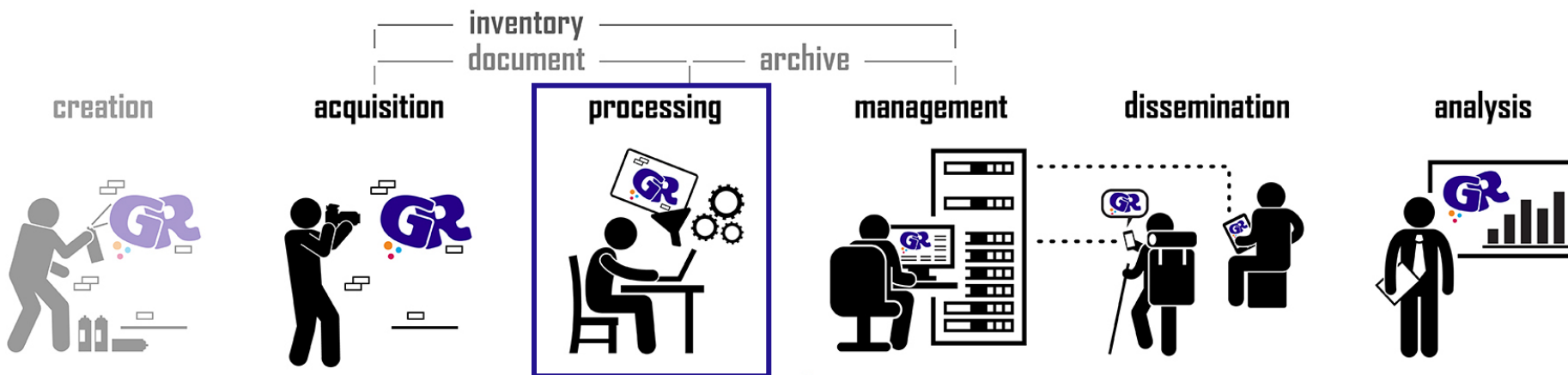
# INDIGO approach



goals



research pillars









main 1 branch 0 tags Go to file Code

dist	Add files via upload	2 months ago
docs	Add files via upload	last month
graffiti_image_processing	Add files via upload	10 days ago
notebooks	Add files via upload	last month
src	Add files via upload	2 months ago
tests/coolpi-gui-test	Add files via upload	last month
wpp_data	Add files via upload	28 days ago
LICENSE	Initial commit	2 months ago
MANIFEST.in	Add files via upload	2 months ago
README.md	Add files via upload	10 days ago
pyproject.toml	Add files via upload	2 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**.

### About

Colour Operations Library for Processing Images

- Readme
- GPL-3.0 license
- 2 stars
- 0 watching
- 1 fork

### Releases

No releases published

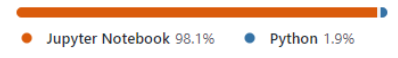
### Packages

No packages published

### Contributors 2

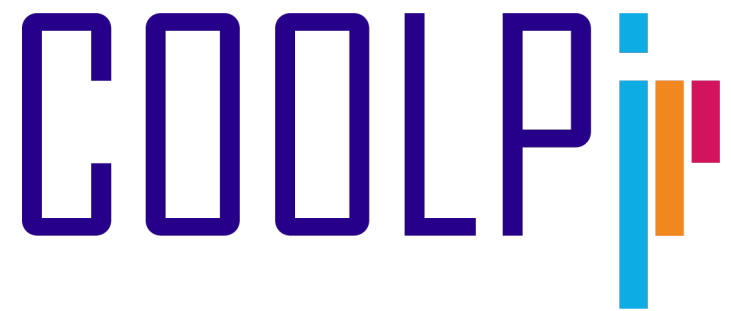
- amolada Adolfo Molada Tebar
- BeyondConventionalBoundaries Geert ...

### Languages



# COOLPI

## colour-accurate pixels





# Contents

## 1 Description

### 1.1 Modules

## 2 Installation

### 2.1 Dependencies

## 3 CIE

### 3.1 Observer

#### 3.1.1 Create an instance

#### 3.1.2 Attributes

#### 3.1.3 Method

### 3.2 Component

### 3.3 SComponents

#### 3.3.1 Create an instance

#### 3.3.2 Attributes

#### 3.3.3 Methods

#### 3.3.4 Plot

### 3.4 CMF

#### 3.4.1 Create an instance

#### 3.4.2 Attributes

#### 3.4.3 Methods

#### 3.4.4 Plot

### 3.5 CFB

#### 3.5.1 Create an instance

#### 3.5.2 Attributes

#### 3.5.3 Methods

#### 3.5.4 Plot

### 3.6 RGBCMF

#### 3.6.1 Create an instance

#### 3.6.2 Attributes

#### 3.6.3 Methods

#### 3.6.4 Plot

## 4 Colour

### 4.1 CIEXYZ

#### 4.1.1 Create an instance

#### 4.1.2 Attributes

#### 4.1.3 Methods

### 4.2 CIExyY

#### 4.2.1 Create an instance

#### 4.2.2 Attributes

#### 4.2.3 Methods

#### 4.2.4 Plot

### 4.3 CIEuvY

#### 4.3.1 Create an instance

## Alert

The dependencies should have been installed automatically along with COOLPI. Please check that everything is correct.

## 3 CIE

The Commission Internationale de l'Éclairage (CIE) establishes standards of response functions, models and procedures of specification relevant to photometry, colorimetry, colour rendering, visual performance and visual assessment of light and lighting (CIE, Division 1: Vision and Colour).

The COOLPI package follows in a rigorous manner the recommendations published by the CIE concerning the standard colorimetric observers, illuminants, the computation of tristimulus values, the colour space conversions formulae and colour difference equations among other colorimetric practices (CIE, 2018).

The CIE objects implemented into the COOLPI package are based on the abstract class *CIE*, and can include other abstract classes according to their requirements. The *CIE* main classes are: *Observer*, *SComponents*, *CMF*, *CFB*, and *RGBCMF*.

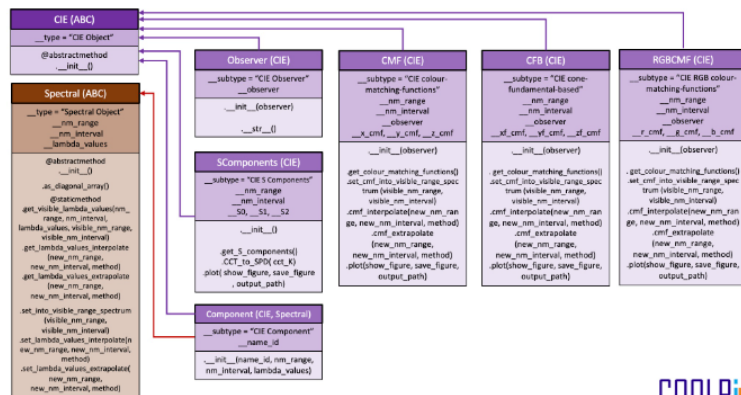


Figure 2: UML Diagram for the CIE classes

## Info

For further explanation of some of the calculations applied, we highly recommend users to consult the standards published by the CIE, particularly the Technical Report CIE 015:2018, Colorimetry, 4th Edition (CIE, 2018). This publication provides the recommendations of the CIE concerning colorimetry, particularly the use of the standard colorimetric observers and standard illuminants, colour spaces, colour difference metrics and other colorimetric practices and formulae.

## Practical use of CIE classes

Users are encouraged to previously take a look at the Jupyter Notebook:

# COOLPI

## colour-accurate pixels





**AUTOGRAF**

**AUTOGRAF**

**position-accurate pixels**





**AUTOGRAF**

**AUTOGRAF**

**position-accurate pixels**







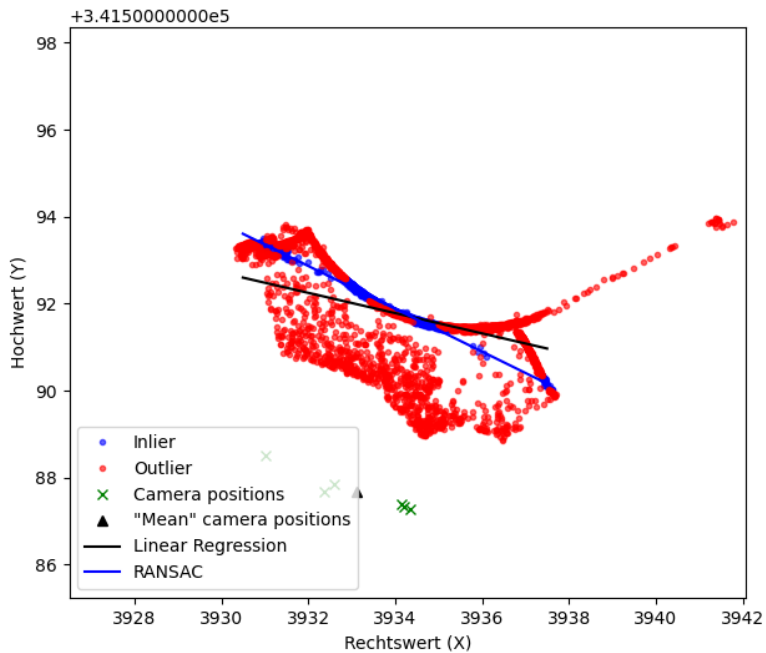
INDIGO Toolbox

1. Choose graffito directory to be processed

2. Run

# AUTOGRAF

position-accurate pixels





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 (AUTomated Orthorectification of GRAffiti 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



# INDIGO approach



goals

create



document



archive



disseminate



analyse



research pillars

creation



acquisition



processing



management



dissemination



analysis







OpenAtlas



CIDOC CRM

spatio-temporal queries

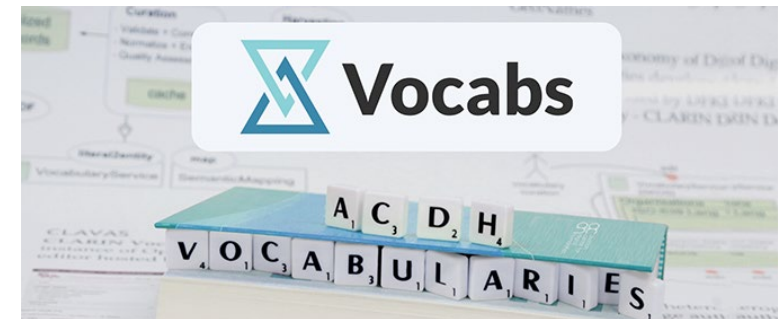


OpenAtlas



CIDOC CRM

spatio-temporal queries



graffiti (mark-making) thesaurus

Getty AAT-based

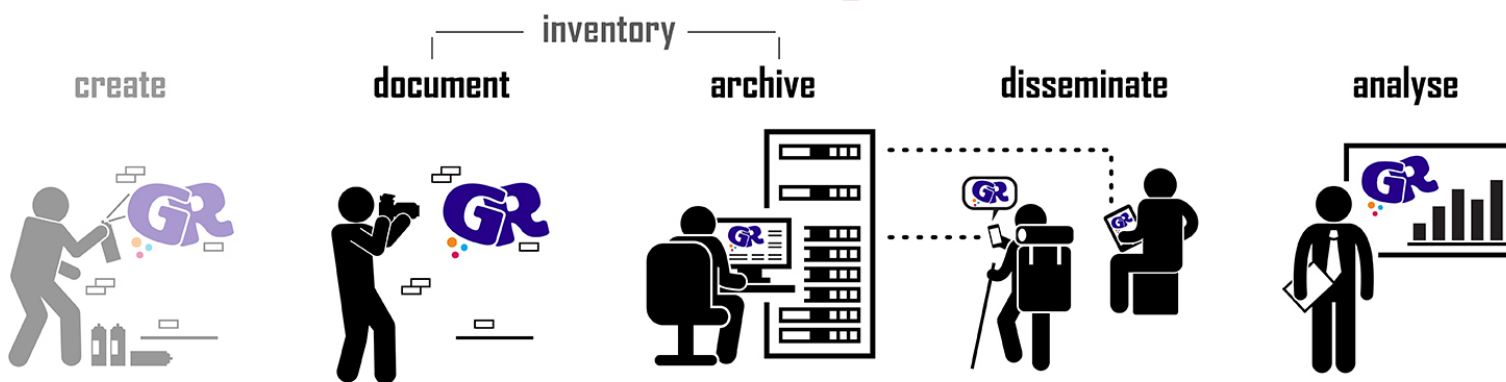
SKOS



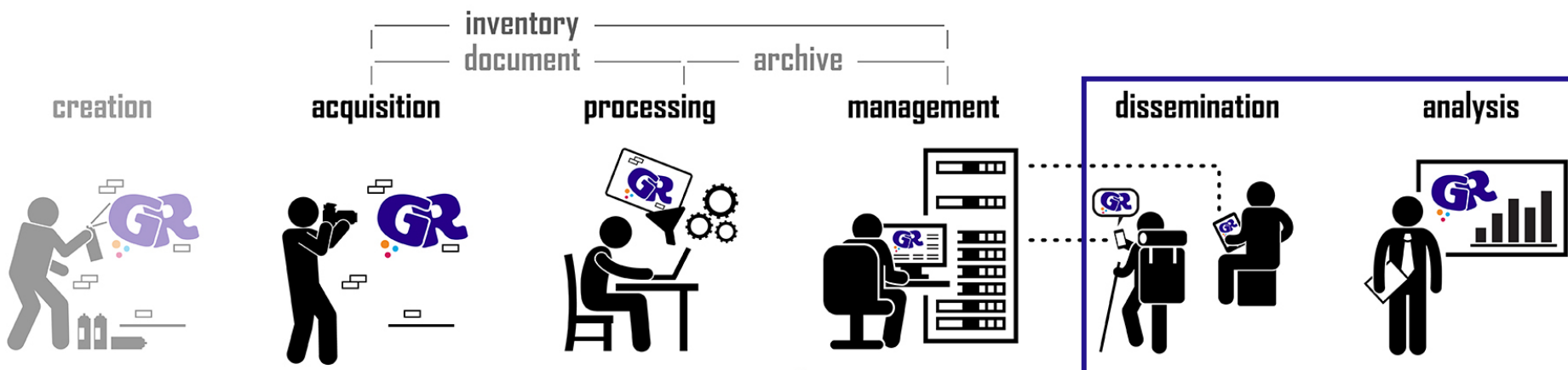
# INDIGO approach



goals



research pillars





# 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**





# INTERACTIVE 3D dissemination

archaeologists / art historians

sociologists / linguists

ethnographers / anthropologists

architects / geographers

ETHICAL + COPYRIGHT aspects

what is cultural heritage ?



# DISSEMINATION **general audience**

**NewsLetter** 

vol.24 - Week 40 - 03-07 October 2022

---

**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 7H + Nikon NIKKOR Z 20mm f/1.8 S @ f/5.6 - 1/400 s - ISO 360

---

 <b>CVL</b> Computer Vision Lab	 <b>UC</b>	
<b>1. CVL meeting</b> Tuesday 27-09-2022   meeting between Sebastian Zambanini of the TU Wien's Computer Vision Lab and Geert to discuss potential thesis subjects	<b>2. Proceedings meeting</b> Wednesday 28-09-2022   the editors of the goINDIGO 2022 proceedings meet to sync info about article submissions and outstanding papers	<b>3. Monthly team meeting</b> Friday 30-09-2022   during monthly team meeting 11, the INDIGO project staff discussed the status quo and talked about upcoming matters

last two weeks

NEWSLETTER

24

# DISSEMINATION **general audience**

Gallery Wednesday



NEWSLETTER

24

INSTAGRAM

400+



# 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 SENARLENS 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 Spraysen 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 Graffiti-Fläche 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 Graffiti-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



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

(Lisa Metzger)

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-

### 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 Spraysen am Wiener Donaukanal legal ist.

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.

**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 Far-

ben 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 Hundertwasserhaus 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? Gewalttätige Datenmengen müssen richtig verknüpft werden. Dabei unterstützen auch Forschungssteams der TU Wien und der Universität Politècnica de València in Spanien. Auch das VRRV, 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 Graffiti-Forschung „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 Fischeskelette 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 Diskussionen 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 Graffiti? 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.

NEWSLETTER

24

PRESS

1

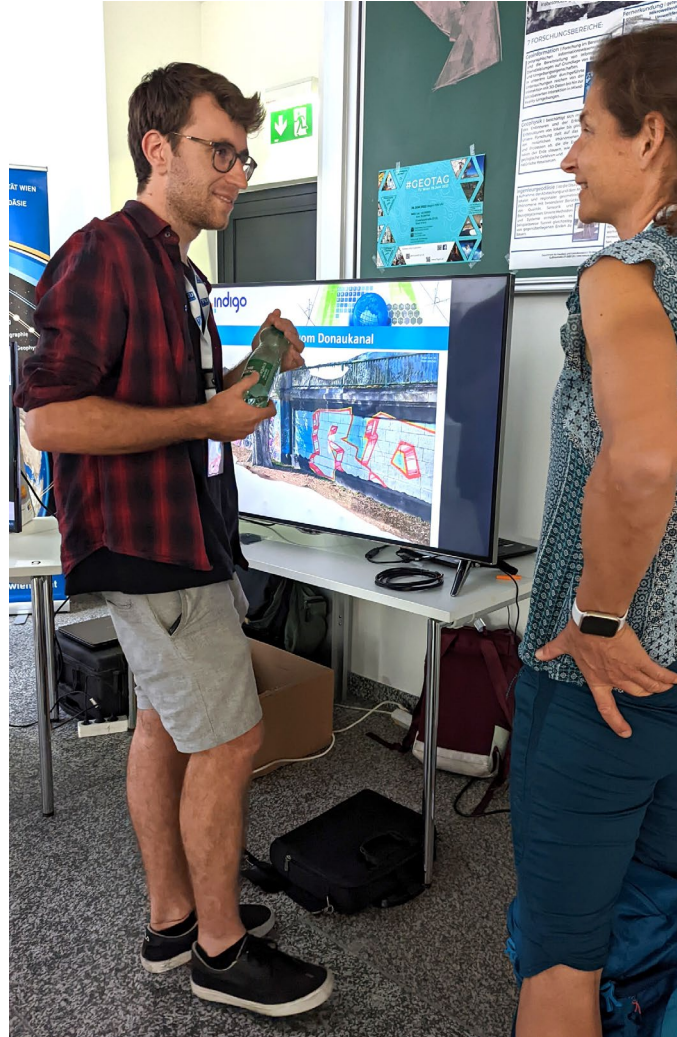
INSTAGRAM

400+

Die Presse 16/07/2022

# DISSEMINATION **general audience**

Lange Nacht Der Forschung 2022



NEWSLETTER

24

PRESS

1

INSTAGRAM

400+

EVENTS

3



# DISSEMINATION **general audience**

ILOVEGRAFFITI.DE Podcast 69

The video player shows a person from behind, holding a camera to photograph graffiti on a wall. The graffiti includes the text 'I LOVE Graffiti.de' and '3070'. The video player interface shows a progress bar at 42:30 / 1:05:05. The video title is 'PODCAST #069: SPRAYCITY.AT'. The video content includes a screenshot of the indigo website, which features a purple header with navigation links (Home, Project details, Contribute, News, Contact), a main content area with a 'Website launched' announcement, and a '3D-ARCH 2022' event announcement for Mantova, Italy, from March 2-4, 2022. The website also mentions '3D-ARCH abstracts accepted' and 'further heritage research'.

PODCAST #069 – Graffiti in WIEN und ÖSTERREICH - SPRAYCITY.AT

5,502 views May 31, 2022

ILOVEGRAFFITI.DE  
45.3K subscribers

SUBSCRIBE

128 Dislike Share Download Clip Save ...

Comments

19

Add a comment...

PODCASTS

2

# DISSEMINATION **general audience**

CIPA Heritage Documentation



Visualisation of present-day Bassianae using an image fusion of the UAS imagery-based orthophoto with a particular relief rendering, PC: Geert Verhoeven

## Interview with Geert Verhoeven, CIPA Expert

...



CIPA Heritage Documentation Emerging Professionals

Published Oct 4, 2022

+ Follow

PODCASTS

2

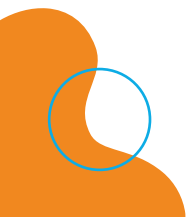
BLOGS

2





# **DISSEMINATION** scientific audience



# **DISSEMINATION** scientific audience

**COOLP** 

The logo for COOLP, with the word "COOLP" in a bold, blue, uppercase sans-serif font. To the right of the text is a graphic element consisting of three vertical bars of different colors: a blue bar on the left, an orange bar in the middle, and a red bar on the right, all of varying heights.

SOFTWARE

2

 **AUTOGRAF**

The logo for AUTOGRAF, featuring the word "AUTOGRAF" in a bold, blue, uppercase sans-serif font. To the left of the text is a graphic element consisting of several parallel diagonal lines of different colors: red, orange, blue, and purple.



# DISSEMINATION **scientific audience**



SOFTWARE

2

HARDWARE

1

# DISSEMINATION **scientific audience**

Heritage [open-access]

Article

## AUTOGRAF—AUTomated Orthorectification of GRAffiti Photos

Benjamin Wild <sup>1,\*</sup>, Geert J. Verhoeven <sup>2</sup>, Martin Wieser <sup>3</sup>, Camillo Ressel <sup>1</sup>, Jona Schlegel <sup>2</sup>, Stefan Wogrin <sup>4</sup>, Johannes Otepka-Schremmer <sup>1</sup> and Norbert Pfeifer <sup>1</sup>

<sup>1</sup> Department of Geodesy and Geoinformation, TU Wien, 1040 Vienna, Austria

<sup>2</sup> Ludwig Boltzmann Gesellschaft—LBI ArchPro, 1190 Vienna, Austria

<sup>3</sup> Independent Researcher, Vienna, Austria

<sup>4</sup> 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 graffiti, 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 graffiti photograph often does not reflect the meaning and setting intended by the graffitiist, 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.

**Citation:** Wild, B.; Verhoeven, G.J.; Wieser, M.; Ressel, 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>

**Academic Editors:** Francesco Fassi, Fabio Remondino and Luigi Fregonese

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*Heritage* **2022**, *5*, 2987–3009. <https://doi.org/10.3390/heritage5040155>

[www.mdpi.com/journal/heritage](http://www.mdpi.com/journal/heritage)

## SOFTWARE

# 2

## ARTICLES

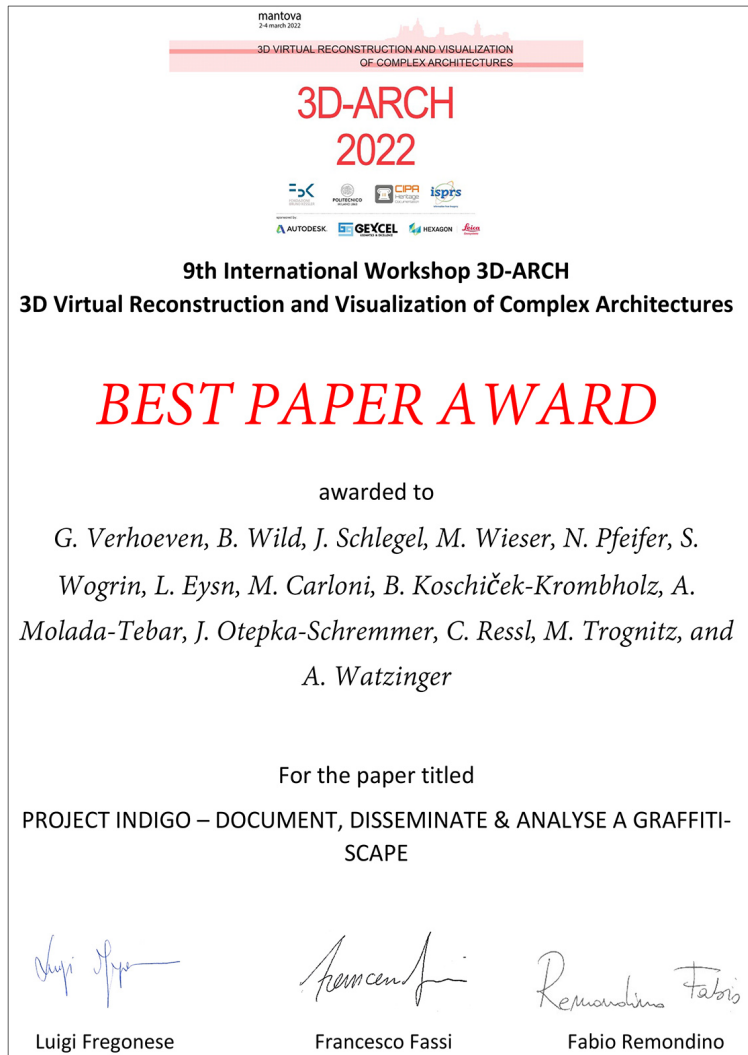
# 3+7

## HARDWARE

# 1



# DISSEMINATION **scientific audience**



SOFTWARE

2

ARTICLES

3+7

HARDWARE

1

AWARDS

1

# DISSEMINATION **scientific audience**



TALKS

11



# DISSEMINATION **scientific audience**

## Acquiring centimetre-accurate camera coordinates in project INDIGO

Martin Wieser | Independent researcher | [scenemap@gmail.com](mailto:scenemap@gmail.com)  
 Geert Verhoeven | LBI ArchPro | [geert.verhoeven@archpro.lbg.ac.at](mailto:geert.verhoeven@archpro.lbg.ac.at)  
 Benjamin Wild | Technische Universität Wien | [benjamin.wild@geo.tuwien.ac.at](mailto:benjamin.wild@geo.tuwien.ac.at)

INDIGO is funded by the Heritage Science Austria programme of the Austrian Academy of Sciences (OAW)

---

3rd Heritage Science Austria meeting: 23 September 2022

(7) Create products

From the georeferenced photo network a 3D mesh, point cloud or orthophotos can be produced in the desired CRS

(1) Mount device

The camera's hot shoe is used for mounting and camera synchronisation

(2) Configure RTK

Input RTK provider (e.g. EPOSA) Provide settings for correction data

(3) Prepare camera

Set and fix focusing Deactivate electronic and optical image stabilisation

RTK GNSS receiver

GPS & Galileo satellites  
L1/L2/L5 multi-band  
RTK

Position

IMU

3-axis gyroscope  
3-axis accelerometer  
3-axis magnetometer

Rotation

Feedback

LEDs & status display

(4) Acquire photos

Follow a specific set of rules:  
 - oblique & perpendicular photos  
 - no change in focus or zoom  
 - different subject distances  
 - cover entire image sensor

(6) Process device data & photos

Use the logged camera positions to georeference and scale the photo network  
With many photos, centimetre accuracy is achievable

(5) Download device data

Download camera positions & rotations over WiFi from the device's webservice via a browser

TALKS  
11

POSTERS  
2

# DISSEMINATION **scientific audience**



TALKS

11

SYMPOSIUM


1

POSTERS

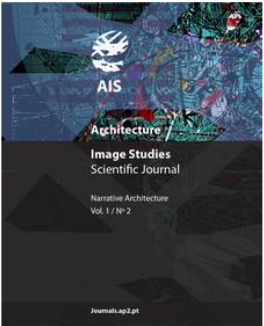
2



# DISSEMINATION **scientific audience**



## UC

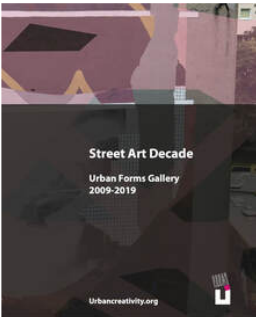


**Architecture Image Studies - Narrative Architecture**

Much of the work published here was initially exhibited in a series of exhibitions, most recently as part of the Shanghai Urban Space Art Season 2019 in the exhibition 'Sensorium'. Through the production of these drawings and texts, the contributors seek to align themselves with a tradition of visionary narratives and use the multiple platforms of dissemination to communicate those ideas to a wider set of audiences beyond architectural academia.

AUTHORS  
Nic Clear, Hyun Jun Park

[Check here the contents](#)  
[Request here the printed copy](#)



**Street Art Decade  
Urban Forms Gallery  
2009-2019**

The book has been created for admirers of urban art interested in learning about and experiencing cityspace. It contains photos and standardised descriptions of all external works completed by the Urban Forms Foundation in the years 2009–2019 mainly in Łódź (Poland).

AUTHORS

TALKS

11

SYMPOSIUM

1

POSTERS

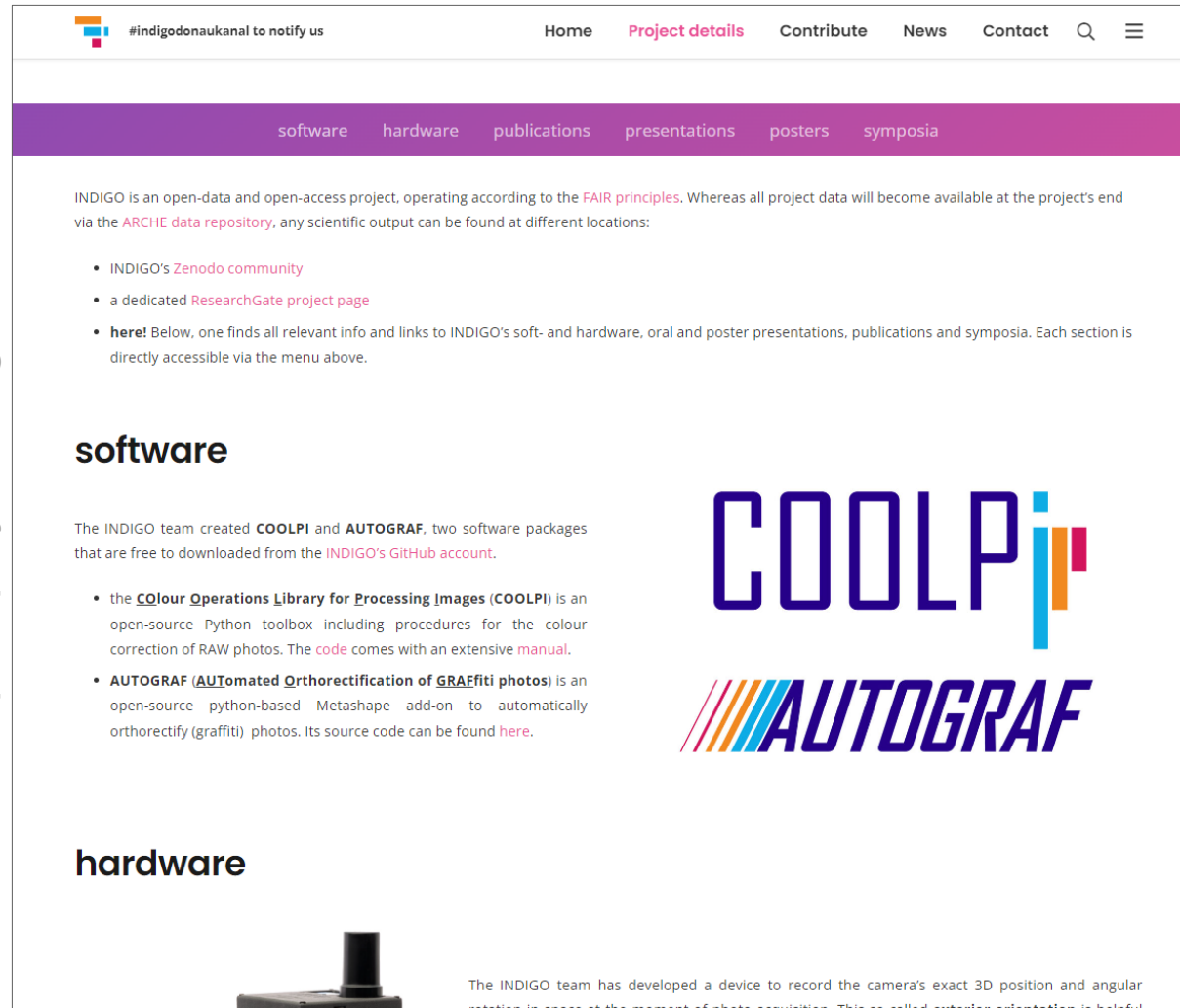
2

EDITED VOLUME

(1)

# INDIGO website

https://projectindigo.eu



#indigodonaukanal to notify us

Home **Project details** Contribute News Contact

software hardware publications presentations posters symposia



INDIGO is an open-data and open-access project, operating according to the [FAIR principles](#). Whereas all project data will become available at the project's end via the [ARCHE data repository](#), any scientific output can be found at different locations:

- INDIGO's [Zenodo community](#)
- a dedicated [ResearchGate project page](#)
- **here!** Below, one finds all relevant info and links to INDIGO's soft- and hardware, oral and poster presentations, publications and symposia. Each section is directly accessible via the menu above.


## software

The INDIGO team created **COOLPI** and **AUTOGRAF**, two software packages that are free to download from the [INDIGO's GitHub account](#).

- the **COLOUR Operations Library for Processing Images (COOLPI)** is an open-source Python toolbox including procedures for the colour correction of RAW photos. The [code](#) comes with an extensive [manual](#).
- **AUTOGRAF (AUTomated Orthorectification of GRAffiti photos)** is an open-source python-based Metashape add-on to automatically orthorectify (graffiti) photos. Its source code can be found [here](#).



## hardware

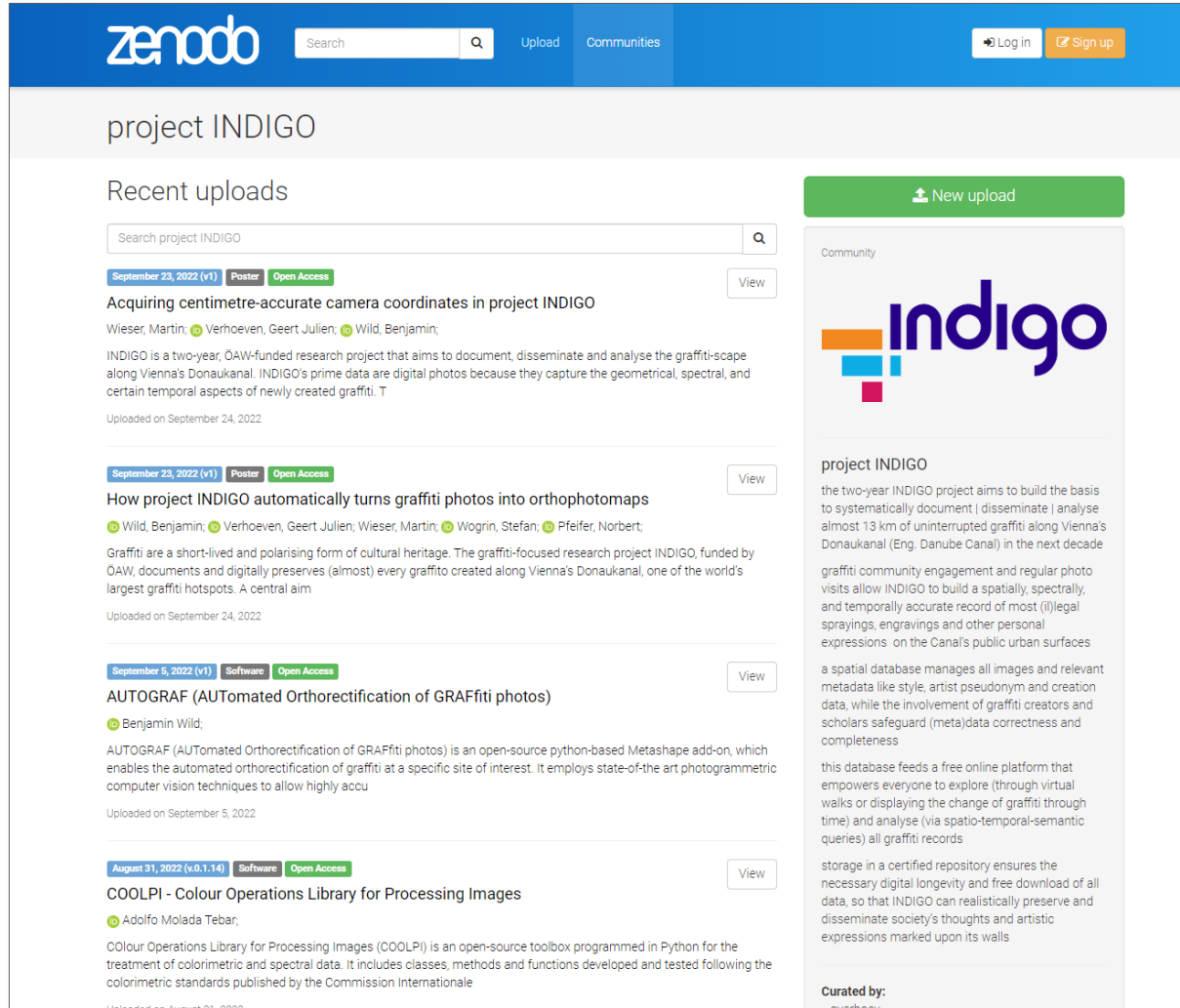


The INDIGO team has developed a device to record the camera's exact 3D position and angular rotation in space at the moment of photo acquisition. This so-called **exterior orientation** is helpful



# ZENODO community

https://zenodo.org/communities/projectindigo



The screenshot shows the Zenodo community page for 'project INDIGO'. The page features a blue header with the Zenodo logo, a search bar, and navigation links for 'Upload' and 'Communities'. There are 'Log in' and 'Sign up' buttons in the top right. The main content area is titled 'project INDIGO' and includes a 'Recent uploads' section with a search bar and a list of four items. Each item has a date, version, and type (Poster or Software) and an 'Open Access' badge. The first item is 'Acquiring centimetre-accurate camera coordinates in project INDIGO' by Wieser, Martin, Verhoeven, Geert Julien, Wild, Benjamin, uploaded on September 24, 2022. The second is 'How project INDIGO automatically turns graffiti photos into orthophotomaps' by Wild, Benjamin, Verhoeven, Geert Julien, Wieser, Martin, Wogrin, Stefan, Pfeifer, Norbert, also uploaded on September 24, 2022. The third is 'AUTOGRAF (AUTomated Orthorectification of GRAffiti photos)' by Benjamin Wild, uploaded on September 5, 2022. The fourth is 'COOLPI - Colour Operations Library for Processing Images' by Adolfo Molada Tebar, uploaded on August 31, 2022. On the right side, there is a 'New upload' button and a 'Community' section with the Indigo logo and a description of the project. The description states that the two-year INDIGO project aims to build a spatial database of graffiti along Vienna's Donaukanal, manage images and metadata, and provide a platform for community engagement and analysis.

# RESEARCHGATE project page

https://www.researchgate.net/project/INDIGO-Inventory-and-Disseminate-Graffiti-along-the-dOnaukanal

**Project**

## INDIGO - INventory and Disseminate Graffiti along the dOnaukanal

Geert J J Verhoeven · Jona Schlegel · Norbert Pfeifer · [Show all 7 collaborators](#)

Goal: This academic graffiti project aims to build the basis to systematically document, monitor, disseminate, and analyse circa 13 km of uninterrupted graffiti along Vienna's Danube Canal in the next decade  
<https://projectindigo.eu>  
<https://zenodo.org/communities/projectindigo>

Date: 1 September 2021 - 31 August 2023

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### Research referenced in this project

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**AUTOGRAF—AUTomated Orthorectification of GRAffiti Photos**

Article Full-text available · Oct 2022 · Heritage

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**Acquiring centimetre-accurate camera coordinates in project INDIGO**

Poster Full-text available · Sep 2022

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