

Building software interfaces to promote students' learning and agency

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SCHOOL of
HUMANITIES
THE UNIVERSITY OF
HONG KONG

Teaching context

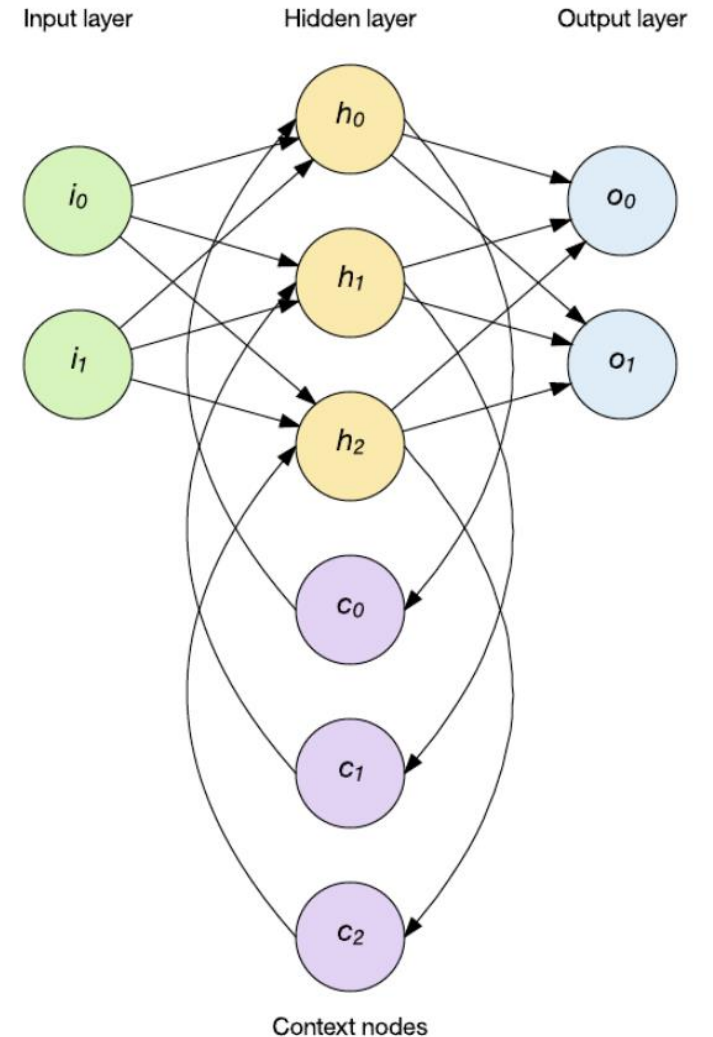
Teaching **quantitative / digital / computational approaches** to students outside of the Faculty of Science

- Faculty of Arts, Common Core program
 - *“Introduction to Data Science”*
 - *“Introduction to Natural Language Processing”*
 - *“Computational Approaches to Language”*
 - *“Digital Humanitarianism (Can you save the world with your computer?)”*

Teaching context

Teaching a range of **techniques**...

- Statistical tests and models
- Machine learning
- Text-mining techniques
- Computational modelling
 - e.g., agent-based modelling

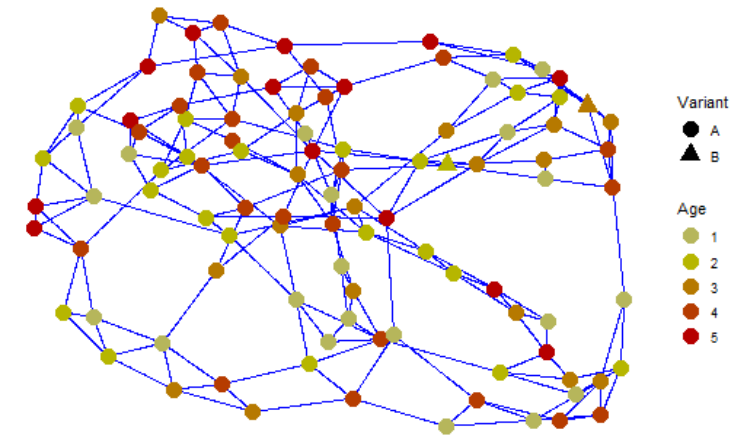


Teaching context

... but also an **epistemology**

- How does one generate knowledge with quantitative / computational approaches?
 - *How to study the diffusion of cultural innovations with artificial populations?*
 - *What are the key differences between an artificial population, and a real one?*
 - *What is the role played by 'randomness'?*
 - *How do various values of the parameters of a model impact the output of a computer simulation?*

Run: 1 -- Time step: 10



The teaching challenge

Students are often concerned they can't come to grips with such topics...

- Although the vast majority is totally capable to do so



... but understanding the role machines and digital tools play in research, art, policy-making etc. is ever more important

What are possible approaches?

Overview

- 1. Teaching approach**
- 2. Focusing on what matters**
- 3. Enriching activities**
- 4. Experimenting and experiencing**
- 5. T&L, research, and art**

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Agency as a teaching philosophy

To tool up someone's power
to act

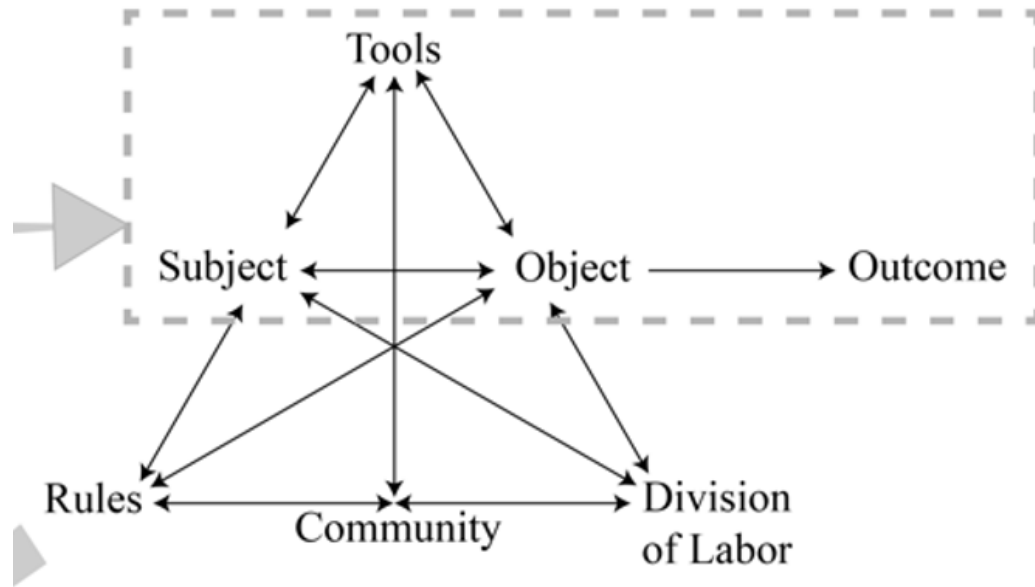
(P. Rabardel)



Pierre Rabardel
(1945-2021)

‘To tool up’: generic / concrete meaning

How to approach activity and agency?



A point of view
from **ergonomy**

Yrjö Engeström's system of activity (1987)

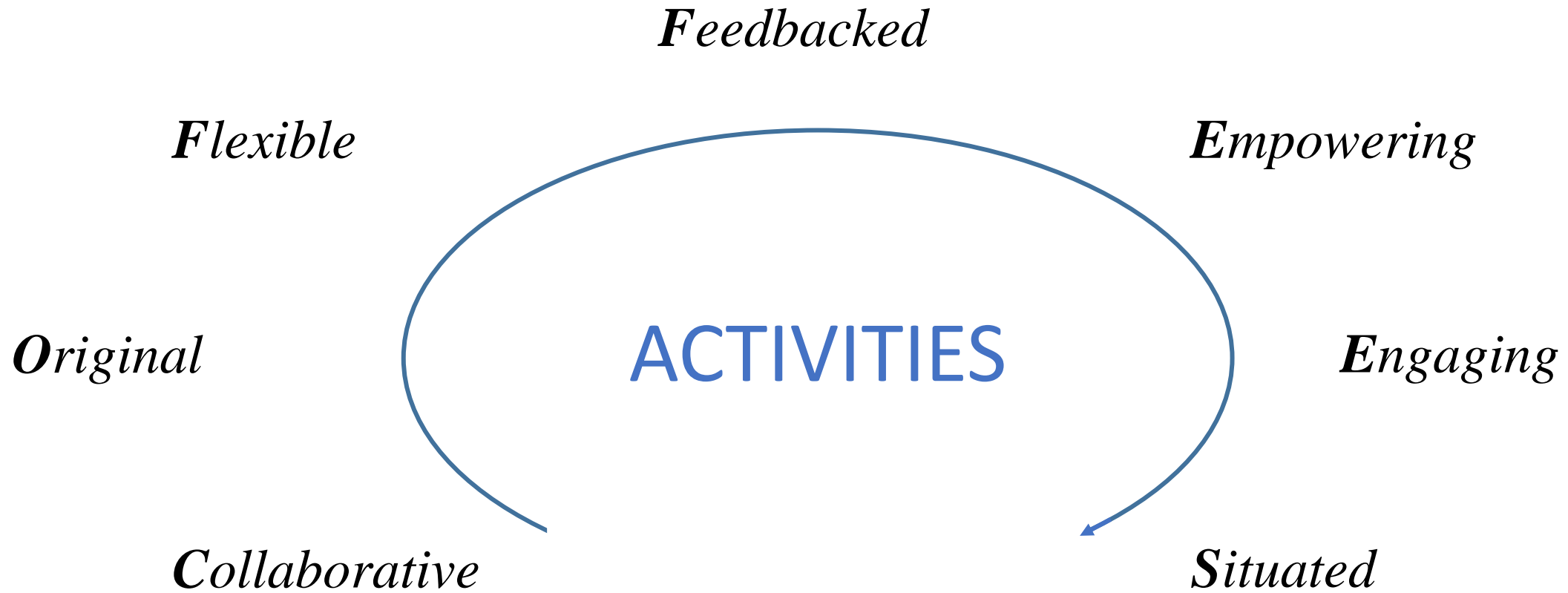
Activity and agency in the classroom?

Design **learning experiences** which

- encompass the 'wholeness' of human activity
- mirror the challenges outside the classroom

Make time for **T&L activities**

- **Flipped classroom** by default



'COFFEES' design principle

Applying COFFEES principles (step by step)

ILO: in a course on language evolution, **reflect on our linguistic abilities and related ‘humanness’**

Step #1: Individual reflection

Lecture on apes trained to acquire language

Each student prepares a list of arguments in favor or against the idea that trained apes should be seen as human beings

Original (using trained apes as a contrastive point)

Step #2: Reflection and feedback

The teacher summarizes students' arguments and comments on them

Feedbacked

Applying COFFEES principles (step by step)

ILO: in a course on language evolution, **reflect on our linguistic abilities and related ‘humanness’**

Step #3: Group debate

Two groups prepare their arguments in favor of or against Nim Chimpsky (a trained ape)’s humanness

They then debate with each other

The teacher throws in some arguments when deemed relevant

Collaborative, Engaging

Step #4: Situated group debate

A background story in which a trained ape sold to a pharmaceutical company kills their abusive caretaker

→ The chimp is trialed, with one group of prosecutors and one group of defense attorneys

Arguments to accuse or defend the chimp may actually promote or minimize their abilities

Situated

It is not always possible, nor likely desirable, to implement all the principles

A journey of gradual refinement - No need to think of everything from the start

How can I 'tool up' my students' agency when it comes to quantitative/computational approaches?

By taking Rabardel's motto literally, and **building software tools which favor agency and learning**

- For T&L activities and graded assignments

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Observations after the first run (1/2)

Students managed quite well and wrote good assignments

- With different text corpora on offer, **students could choose what they preferred**, and **grading was less repetitive**
- Some students asked to work on other texts
 - e.g. *The Communist Manifesto* by K. Marx

Observations after the first run (2/2)

However...

1. Installing required software turned out to be more time-consuming than thought of at first
2. It was quite easy to modify the code inadvertently, and students were often not able to trouble-shoot an unexpected error. Need to ask and wait for help
3. Some students (rightly) complained the whole thing was too complex and confusing
4. The programming part was not that relevant. **Understanding text-mining takes place at a higher level**

TAME: *Text Analytics Made Easy*

To improve on the previous approach, develop an online interface offering the same ‘affordances’

- Easy to access and use (no installation needed)
- Focus on the outputs of various text-mining tools
 - as they could be found in other software
- Focus on complementary perspectives on the same set of documents

TAME: *Text Analytics Made Easy*

TDG grant to recruit two CS students to get help

- Develop a set of interfaces, especially in relation to text mining/analytics
- Did not require amazing programming skills, but a more global understanding of how these interfaces could enhance T&L

Different languages for the interface

- English, French, Mandarin

Freely available (online)

Observations after the next run(s)

- 1. Much easier to investigate a set of documents**
- 2. Interesting, varied and nuanced assignments**
- 3. No more complaints**
- 4. Positive evaluations, students reporting that the ILOs were achieved**

Focus on what matters

At the right level

New **opportunities** offered by digital tools

- E.g., Revisiting old questions, addressing large volumes of data

Limits

- E.g. reductionism, opacity

Possible **pitfalls**

- E.g., algorithmic bias

Text Analytics Made Easy

English

Select corpus: movies, HongKong

Select the set of documents you want to analyse:

- action
- comedy
- crime
- crime thriller
- drama
- horror
- martial arts
- romance

Select the linguistic categories you want to analyse:

- Open_class
- Closed_class
- Others

Choose inflected forms or lemmas:

- Inflected forms
- Lemmas

Enter the inflected forms or lemmas you want to discard (stopwords):

Load common stopwords | Empty the list of stopwords

Stop words:

Frequency of occurrence | Co-occurrences | Collocations | Distribution of Part-Of-Speech | Linguistic units | Sentiment Analysis

Topic modeling | Part-Of-Speech

Barplot and network for cooccurrences of terms

Note: The displays below account for the selection of documents, grammatical categories, linguistic unit (inflected form or lemma) and stopwords in the side panel

Size of the window around a word to look for other occurring words: 0

Number of cooccurrences displayed in the barplot: 30

Number of cooccurrences displayed in the network: 200

Barplot of the most frequent cooccurrences within the document(s)

Most frequent cooccurrences within the document(s)

Competition of two linguistic variants on social networks

English

Parameters

Simulation

Time limit: 100

Number of runs (how many simulations with the same values of the parameters): 1

Social structure

Type of network: random

Network: small-world | scale-free

Number of nodes: 100

Average number of neighbours: 10

Linguistic model

Functional bias in favor of variant B: 1.5

Probability of imperfect learning: 0.05

Modify status at birth: no

Run simulation

Visualization of the network

Run to visualize (if more than actual number of runs, show you the last one)

Time step to visualize: 1

Evolution of the linguistic system

Evolution over time

Network

Run: 1 - Time step: 1

Population diffusion

Description

This interface lets you observe the spread of a population in an area composed of adjacent cells. Each cell is characterized by a carrying capacity, and migration favors higher carrying capacity.

Choose an area: Australia

X coordinate for the point of origin: 400

Y coordinate for the point of origin: 500

Initialize the simulation

Number of timesteps: 75000

Run the simulation

Reset the simulation

Distance-based methods

Number of taxa: 12

Initialize the matrix | Create a matrix for Indo-European languages

	0	30	10	70	1	10	1	1	20	10	20	10
Dutch	0	30	10	70	1	10	1	1	20	10	20	10
English	30	0	10	10	1	10	10	11	1	10	1	10
French	10	10	0	1	1	90	1	1	20	80	20	99
German	70	10	1	0	1	1	1	1	10	1	10	1
Hindi	1	1	1	1	0	1	60	22	1	1	1	1
Italian	10	10	90	1	1	0	1	1	20	70	20	90
Nepali	1	10	1	1	60	1	0	33	1	1	1	1
Persian	1	11	1	1	22	1	33	0	1	1	1	1
Polish	20	1	20	10	1	20	1	1	0	20	40	30
Portug.	10	10	80	1	1	70	1	1	20	0	20	70
Russian	20	1	20	10	1	20	1	1	40	20	0	20
Spanish	10	10	99	1	1	90	1	1	30	70	20	0

Input random numbers in the matrix

Choose the algorithm you want to apply: UPGMA (average)

Compute the output with values representing a distance | Compute the output with values representing the opposite of a distance

Output of the algorithm

TEACHING DEVELOPMENT GRANT

15 online interfaces to 'flesh out' the exploration of various areas of linguistics

TEACHER'S PROGRAMMING

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**Developing even a simple interface can
participate in enriching a T&L activity**

- Make an activity more original, situated, engaging, collaborative etc.

Greater flexibility *without the hassle*

With the TAME interface, students can currently choose between a number of text corpora

- Adding a new resource is possible, but currently requires slightly modifying the code

In progress: tapping into Project Gutenberg's online database of over 60,000 ebooks

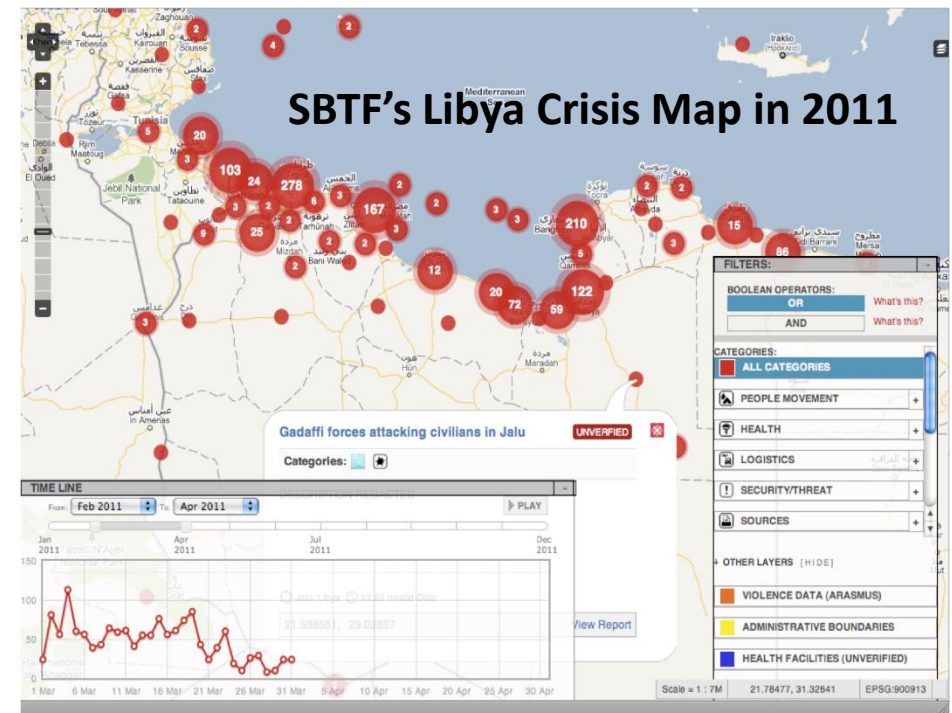
- Allowing users to quickly add text resources by themselves
- A student can choose the book they want to study
 - *More flexibility, more agency, more engagement*
- The teacher does not need to get involved, and grading becomes even more varied 😊

Building collective maps

Have students experiment with ‘crowdsourced (online) crisis mapping’

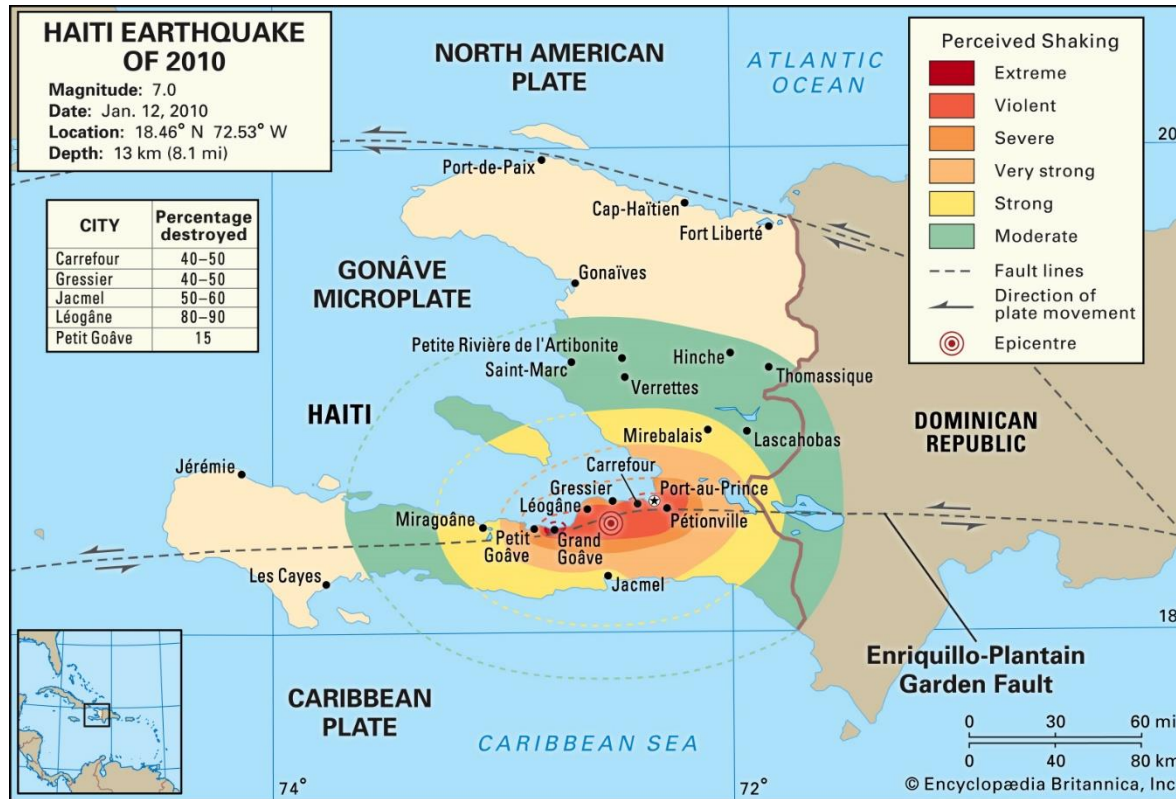
- (CC course ‘Digital Humanitarianism’)

Objective: prepare accurate digital maps of a disaster-struck area with actionable information for rescuers ‘on the ground’



Situatedness: the 2010 earthquake in Haiti

January 12, 2010



People with desperate needs for various resources

- Food, water, medical supplies etc.
- Very severe emergency situation

First run of the activity

Provide groups of students with a text file containing a large number of SMS sent in the aftermath of the earthquake

- Actual messages sent in 2010 (sensitive information discarded for ethical reasons)

1. Ask them to analyze these messages

- Distinguish relevant from non-relevant, actionable from non-actionable information
- Categorize the various needs of the population

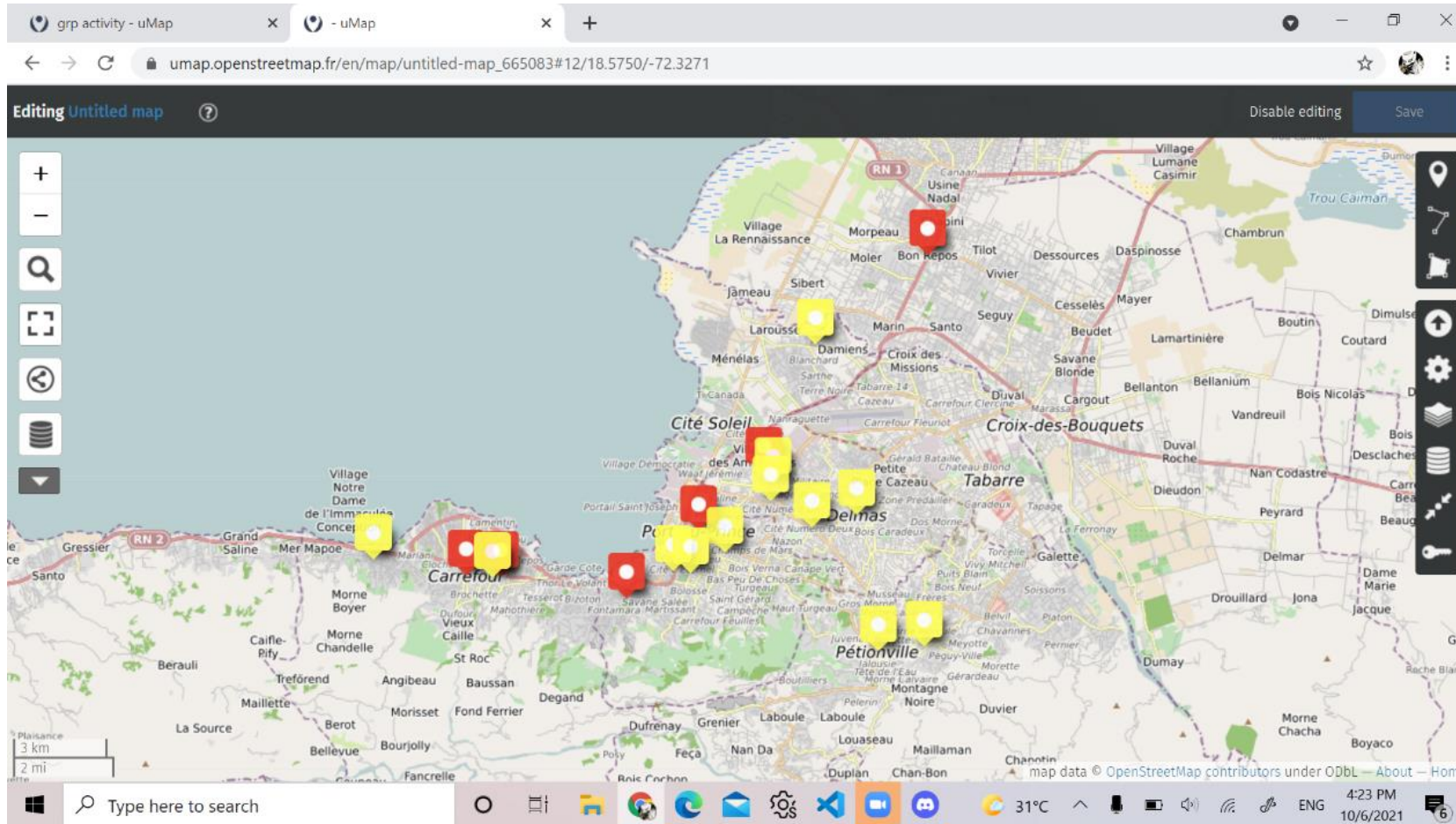
2. Ask them to create an online digital map which could be useful to humanitarian field workers

Flexibility in terms of approach and group work, hopefully **original**



```
1 Message
2 Weather update - a cold front from Cuba that could pass over Haiti
3 Is the Hurricane over or is it not over
4 says: west side of Haiti, rest of the country today and tonight
5 Information about the National Palace-
6 Storm at sacred heart of Jesus
7 Please, we need tents and water. We are in Silo, Thank you!
8 I would like to receive the messages, thank you
9 There's nothing to eat and water, we starving and thirsty.
10 I am in Petionville. I need more information regarding 4636
11 I am in Thomassin number 32, in the area named Pyron. I would like to have some water. Thank God we are fine, but we desperately need water. Thanks
12 Let's do it together, need food in Delma 75, in didine area
13 More information on the 4636 number in order for me to participate. ( To see if I can use it )
14 A Comitee in Delmas 19, Rue ( street ) Janvier, Impasse Charite #2. We have about 500 people in a temporary shelter and we are in dire need of Water, Food,
Medications, Tents and Clothes. Please stop by and see us.
15 We need food and water in Klecin 12. We are dying of hunger. Impasse Chretien Klecin 12 extended ( extension ) We are hungry and sick.
16 I don't understand how to use this thing 4636.
17 I would like to know if the earthquake is over. Thanks
18 I would like to know if one of the radio ginen Journalist died?
19 I'm in Laplaine, I am a victim
20 There's a lack of water in Moleya, please informed them for me.
21 Those people who live at Sibert need food they are hungry.
22 I want to say hello, my message is to let you know that there's an area in faustin Anhy street that has nothing neither food, water and medicine,
23 Can you tell me about this service
24 How can we get water and food in Fontamara 43 cite Tinante?
25 We need help. Carrefour has been forgotten completely. The foul odor is killing us. Just letting you know. Thanks!!
26 Good evening, Radio one please. I would like information on Tiyous.
27 We have a lot of problem at Delma 75 Avenue Albert Jode, those people need water and food.
28 I'm here, I didn't find the person that I needed to send the pant by phone
29 People have been sleeping outdoors in a field near Lilavois since 12 Jan. No coords on Lilavois but apparently it is near PaP
30 We want you to know that Carrefour need help, we starving to death.
31 I would like to get help at Cote Plage in Carrefour
32 I am in Leoganes, where can I get food? Please
33 The Comite Miracle in the area of Alerte Rue Monseigneur Guilloux, ( Streets, Alerte and the cross street is Mgr Guilloux ) would like to urgently receive food,
water and tents for the people in that area. Thanks
34 People from Dal blocked since Wednesday in Carrefour, we having water shortage, food and medical assistance.
35 In Jacmel it's not working at all, because people are dying of hunger.
36 We have no one everybody is dead.
37 We don't talk about Petit-Goave, Please, look into Petit-Goave.
38 People in Fontamara 27 in impass area Pierre Louis having lots of difficulties, please help, ASAP.
39 Good evening, I congratulate you for all the good work and with strenght i'm listening from Matisan 1, we have water and food shortage but God provided his grace
```

Resulting maps



Next runs

Add some 'spice' to the activity

Messages are not sent in bulk, but delivered in a manner closer to what early crisis mappers faced in 2010

- Strong and clear time constraints
- Overload of information (compounded by the time constraints)

Forces students to better distribute tasks in the groups

- More collaborative, more engaging

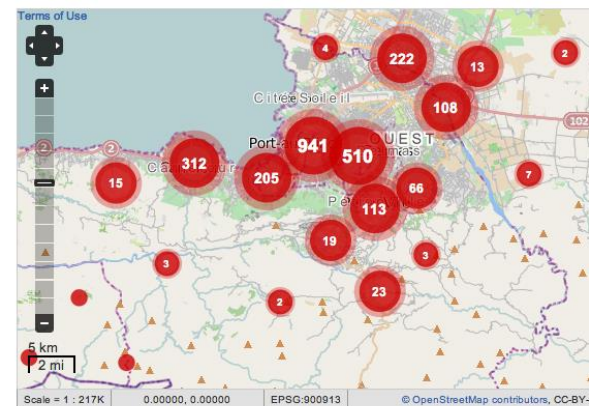
A component among others (1/2)

The interface impacts the activity, but is **only one of its components**

Other components to meet the COFFEES design principles

- All student groups submit their maps – the best earn a small bonus
- Collective **feedback** on the different maps, discussion about various approaches (sharing the workload, designing the map), comparison to the original map

Original map



ALL CATEGORIES	
!	1. URGENCES EMERGENCY
🚚	2. URGENCES LOGISTIQUES VITAL LINES
🏥	3. PUBLIC HEALTH
🚧	4. MENACES SECURITY THREATS
🏠	5. INFRASTRUCTURE DAMAGE
⚡	6. NATURAL HAZARDS
+	7. SECOURS SERVICES AVAILABLE

<https://irevolutions.org/2011/03/06/changing-world-map/>

A component among others (2/2)

Other components to meet the COFFEES design principles

- Students further participate in online humanitarian mapping projects, and report their work
- Choose their own projects (**flexibility**)
- ~400 hours each year to support humanitarian organizations
- **Concrete, impactful, empowering contribution**
- **'Hardware, Software and Heartware'** (Dr Nason Tan, MSF HK)

CCGL 9061 DIGITAL HUMANITARIANISM
#6279: EBOLA PREPAREDNESS MAPPING, KAGADI DISTRICT, UGANDA

BACKGROUND OF KAGADI
Kagadi is a 48 km square town located in the western part of Uganda, Africa (Uganda Bureau of Statistics, 2017). Like many underdeveloped regions, their economy is mainly focused on the agricultural sector (Uganda Bureau of Statistics, 2017). For almost half of the population, the distance between their house and a public health facility or a police station is more than 5 km away (Uganda Bureau of Statistics, 2017). This can be problematic, as they are unable to obtain immediate help when required, especially when there is a spread of a highly fatal and contagious disease such as Ebola.
GDP per Capita: \$57

WHY DO THEY NEED MAPPING?
The health situation in Uganda is extremely worrying as the five leading causes of death in Uganda were diseases like HIV/AIDS, tuberculosis, malaria etc. as of 2016 (WHO, 2019). In a nation where people don't have enough money to pay the medical bills, the government has to shoulder some part of the expenses, however, the government in Uganda has insufficient funds to do so. Thus, they have no choice but to reduce the number of hospitals. As a result, those who live in remote districts are unable to access medical facilities. One way to stop this situation from worsening is by providing more accurate maps for the health care workers so that they can get to the affected area quickly and stop the plague from spreading. That's why our work is important and indispensable.

HOW MAPPING HELPS THE SITUATION

1. Mapping helps to identify patterns between environmental conditions and the socioeconomic data. This can be used to predict changes in health based on the environmental changes.
2. Spatial tools with high communication power can be very useful to humanitarian workers in both local and international bodies.
3. Increase effectiveness and efficiency and allow the proper allocation of resources like food, water and human assistance to the required areas.

CHALLENGES FACED

- Buildings & land: Hard to identify building type and the use of land (housing, restaurant, etc). Also difficult to locate it in areas with low quality imagery.
- Forest: No clear indication of the type of vegetation and lack of a clearcut boundary to show where the area ends.

IMPROVEMENTS/ SUGGESTIONS:

- 1st possible solution → NGOs or local organization can provide more information for the building type to keep the mapping work more consistent. E.g setting the land usage. With advancement in technology, it may be possible to invest in SAR to obtain higher quality images.
- 2nd possible solution → Setting the common rules for the user maximum distance between trees and the number of trees required for an area to classify as a forest.

WHAT DID WE LEARN?

- After mapping the Kagadi district in Uganda using the satellite imagery, we learn that the area has poor economic conditions and it is severely under-developed.
- Many buildings are not even connected by roads which makes traveling and providing medical relief to them extremely tough. Public facilities (such as schools, hospitals and medical clinics) are absent for the most part or extremely tough to find. Only a few schools were found while mapping and the quality of education imparted in the schools is another issue.
- Land usage is not optimum as there are empty patches of land all over the area and trees growing around them. From the satellite images, it looked like most of the empty areas were not even used for agricultural purposes properly.
- Kagadi district in Uganda borders the Democratic Republic of Congo where the ebola virus has claimed hundreds of lives and thousands have contacted the virus (Tumuhimise, 2019). Therefore, the Kagadi district is at a high alert and mapping these parts of Uganda, even if it is only a small contribution, will be beneficial to NGOs like the Red Cross, MSF, etc. but will also help the local people and government to get something fundamental like maps (MSF, 2019).

FINAL GOAL

Group members:
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Figure 2 Screenshot of the Openstreetmap, which shows the total mapped area in task 6279.

Figure 3 Screenshot of Google Maps, which shows mapped area in Sai Ying Pun.

Our final purpose is to make the map of Kagadi have the high level of mapping details like the map of Hong Kong.

REFERENCES

Daily Monitor. (2019, January 23). Ebola, poorest district. Daily Monitor. Retrieved from <https://www.monitor.co.ug/News/National/Ebola-poorest-district-uganda/585551-5272501-upton/index.html>
MSF. (2019, April 23). Mapping Maps: prepare. Monitor News Frontiers. Retrieved from <https://www.monitor.co.ug/news/mapping-maps-prepare>
Tumuhimise, A. (2019, April 20). Uganda Kagadi Is Ebola Scare: A Clear Sign, The Monitor. Retrieved from <https://daily.monitor.co.ug/2019/04/20/142.html>
WHO. (2019). Impact assessment. (2019). Retrieved from <https://www.who.int/teams/impact/>

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One may feel software interfaces can only relate to techniques, experiments, hard science etc.

Analyzing semantic representations and variation

Instructions

1. Please enter your code and the semantic field, and press the 'Load data' button
2. Choose the participants you want to visualize and press the 'Display button'
3. Save the maps you want.

Your code:

Choose the semantic domain

world cities (Chinese)

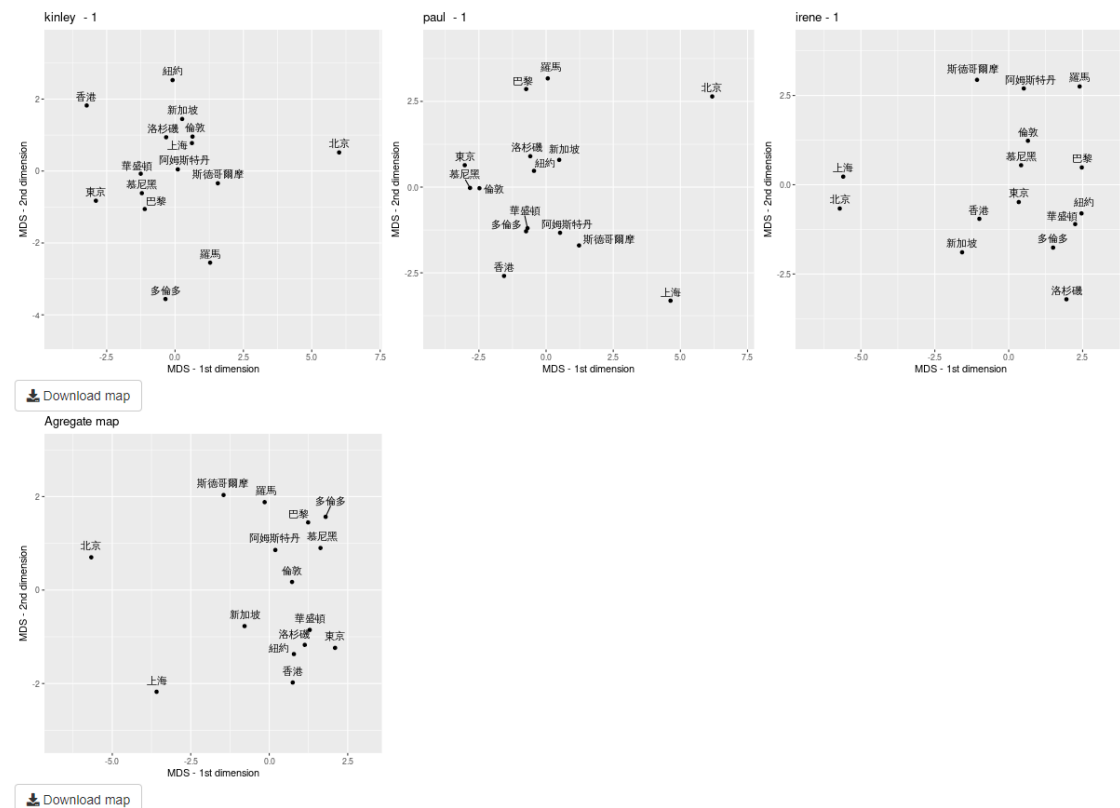
Load the data

Select the participants you want to visualize

- kinley - 1
- paul - 1
- irene - 1
- anson - 2
- wing chan - 1
- arthas - 2
- teenie - 2
- yvonne - 1
- catherine - 1

Visualize the selected data

Reset



However, one may also touch upon **human experience**

Tools to *access and question* subjectivity, perceptions, feelings, emotions

The EGoHK Project (Experiential Geography of Hong Kong)

CCGL9061 – Digital Humanitarianism

An online platform, accessible
through mobile phone, to collect
data on students' lived experience
(<https://keruiduo.shinyapps.io/egohk/>)

EGoHK: You and the City.

1. Choose a colour which best describes what you're experiencing right now.

#ade01d

My color

2. Choose a single word to describe what you're experiencing right now.

Incomplete

3. Briefly answer the five following questions.

In this very moment, what are you doing here?

Working on the assignment the mapping project.

In this moment, what do you perceive of the space AROUND you?

The space facilities free thinking and self talk. There's nothing that can move me out of my active mind and heart at this moment.

In this moment, what do you perceive of the space WITHIN you?

Space within feels more troubled than usual.

In this moment, how would you describe your present experience (perhaps some thoughts, some feelings, some inner language)?

It's as though I've lost a loved one, or my lover has tormented me with ignorance, or perhaps I've done something irreparable.

In this moment, who do you feel like you are?

Young Werther!

The EGoHK Project

Strong guarantees of anonymity and absolute freedom in choosing what to report

- Flexibility

One's own intimate world to be shared

- Engagement, situatedness

After data collection, groups of students create video reports on their experiences and their participation to the project

- Collaborative work, empowerment
- Feedback by the teacher & the TA

In this moment, who do you feel like you are?

*“Just a normal university student”
(very common)*

“A bird happily chirping in the early morning”

“A fish being pushed by the waves, unable to find its way”

“Aristotle before his death”

“An ant on the hot pan”

“Not the best version of me”

“A self-absorbed being who is throwing all the stress away on the EGoHK interface for self-soothing”

Once again, a piece of software as a component of a more holistic approach promoting agency

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The various pieces of software introduced previously primarily support T&L

They can also promote **research and **art****

Back to the EGoHK project

The data collected during the project can be analyzed to answer different questions

- *Do emotions and experiences associate to specific colors?*
- *How does time affect subjectivity?*
- *Are some locations in HK more associated with positive or negative emotions?*
- *What is the range of experiences lived by students?*

Use of data science and text-mining techniques

Partnership with Chan Kwan Kin (Ken) (undergraduate student)

The HK Streets walkability project

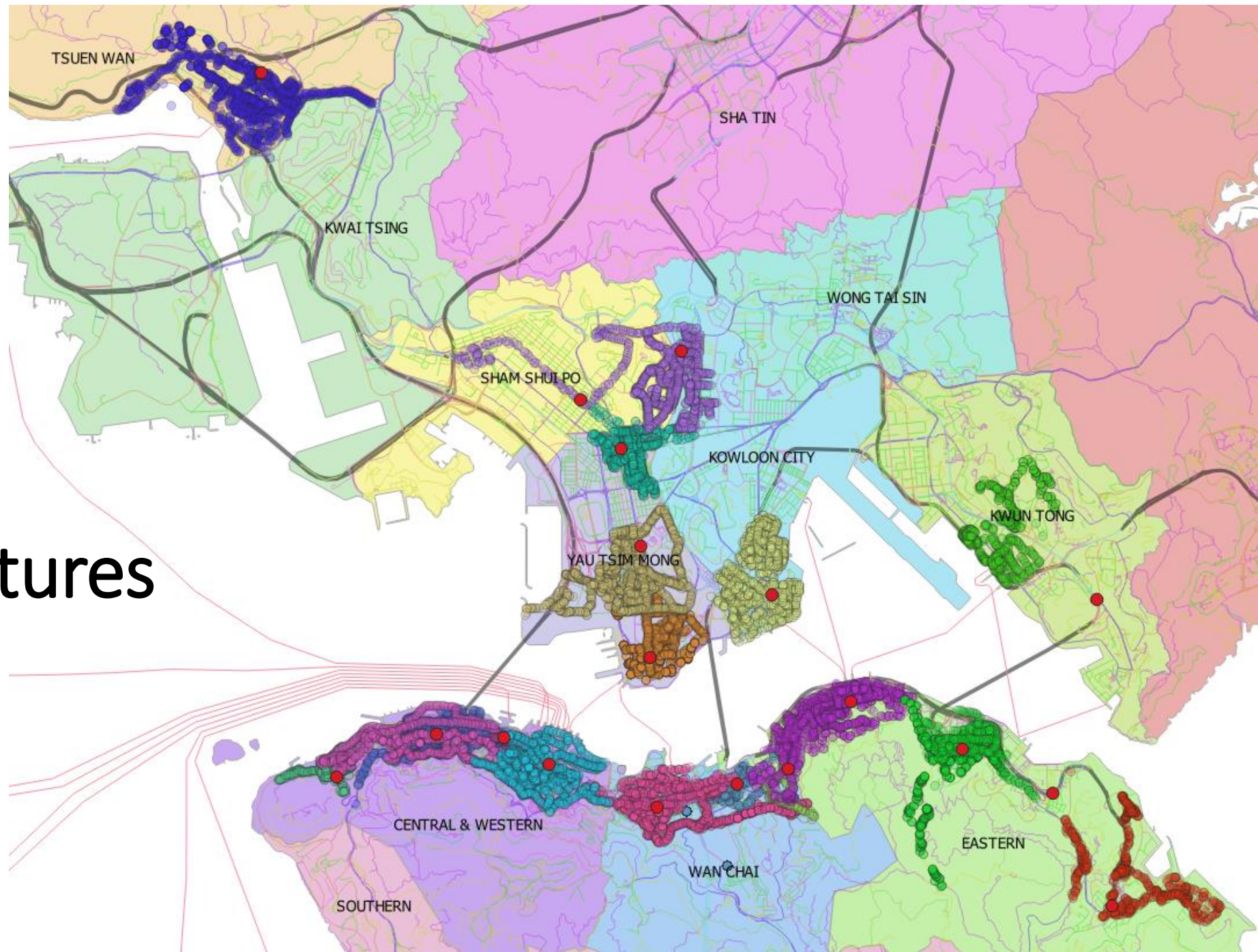
A project to better understand how easy it is to walk in various areas of Hong Kong (digital humanitarianism)

Students took pictures of areas around MTR stations - one picture of the sidewalk on each side of each street every 25m



A LOT OF pictures

> 18,700 geotagged pictures (and some others without the tags...)



Investigating walkability

The students pondered over the various factors impacting walkability

- Especially for young children, elderly

They also participated in a pair judgment task for a selection of 3,000 pictures, thanks to a **dedicated interface**

- Around 43,000 pair judgments, used to compute a walkability score for each pic

They prepared a video report on walkability, their reflections and their participation to the project

On-going research

Shift from the 3,000 pictures to the full set of pictures

Deep learning methods to learn what impedes or favors walkability, and then predicts walkability as accurately as possible

- Transfer learning with networks pre-trained on street pictures for image segmentation

Analyze walkability at different spatial scales and time periods

→ Leveraging the students' involvement

A more artistic T&L activity

Some awesome and free software is already available online!

E.g., deep style transfer to work on visual communication

- <https://deepdreamgenerator.com/>

Students are tasked with creating an interesting image about humanitarian action and humanitarianism

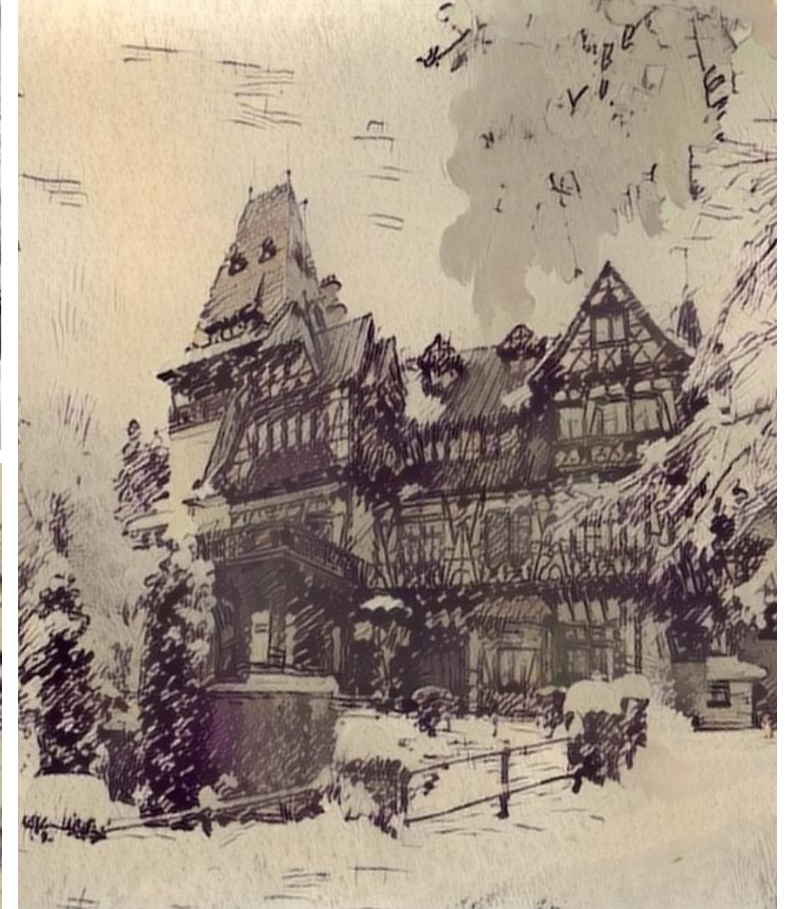
- Plus write a short meaningful description/explanation of their image

Images are peer-reviewed, commented and voted by the whole class

Deep style transfer

Deep-style transfer is a technique to blend the surface / style of an image with the content of another one

Allows to create interesting / surprising / artistic images



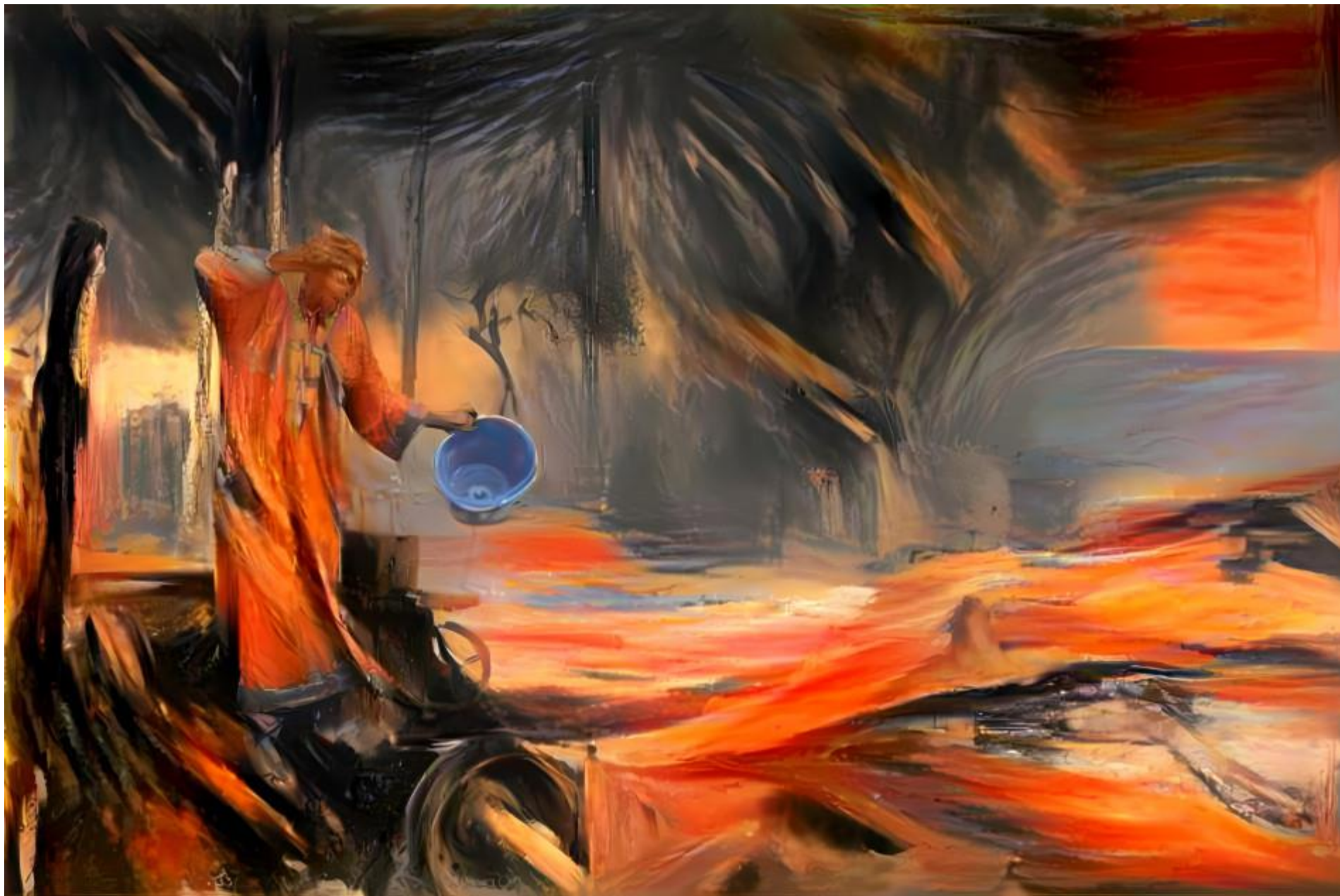


Febrina Audrey

‘A child in conflict-torn Chad walks past a wall with drawings of rocket-propelled grenade launchers. He imagines what life below water looks like: with teeming coral reefs, and blue whales instead of grenade launchers travelling in pods. His imagination and his hope for peace keep his uneasiness at bay.’



Ho Kin Ling



Kwong Hoi Shan



Leung Si See



Maydeline Fonda



Ip Wing Yi

Conclusions (1/2)

Software interfaces can **support and enrich teaching & learning**

- Create **better-rounded experiences** and **promote agency**
- Any topic may benefit from the development of T&L digital tools

These tools and their design can **co-evolve with the broader pedagogical process**

Beyond T&L...

- They can form the basis of **research projects**
- **Art and creativity** can be considered along the way

Conclusions (2/2)

I am confident that the software I have shown you benefit my students

- Scholarship of T&L, students' evaluations and detailed comments, my own perceptions in the classroom

Is it for everybody?

- I like building digital tools, and I am an experienced programmer → easier for me, and less time-consuming
- But one can **partner with programmers** and provide specifications (e.g., with a TDG grant)
- The tools do not need to be very complex to be effective!

A meaningful mid- to long-term investment

- Developing an interface can take time
- But it can be used by hundreds of students if used over the course of a few years
- Once ready, it actually saves time for both the students and the teacher