TOPIC 1 - ONE PAGER

PROJECT OUTLINE
CONVERSATION OF DAY 1
CONVERSATION OF DAY 2 -> Towards an integration of the different perspectives

Daylight for healthy living spaces – in urban and natural environments

Project outline

TITLE	Daylight for healthy living spaces – in urban and natural environments
ABSTRACT	Daylight provides essential information and physiological cues for humans and natural systems, it delivers free and sustainable energy for use as lighting, electricity and heating, to power photosynthesis and govern natural life cycles of living organisms. Harnessing the power of daylight offers a broad portfolio of solutions to contribute to the achievement of the sustainable development goals (SDGs). Daylight, however, is fundamentally local and stochastic, depending on the geometry of the local space and the chaotic behavior of weather

	conditions. In order to promote the application of daylight science in architecture, medicine, technology and natural science we invite you to discuss how to map daylight characteristics for the planet. Products might include a global daylight atlas, algorithm or database providing daylight information for living systems, urban spaces or energy harvesting applications.
PROPOSED BY	Bernhard Wehrli and Arthur Gessler
GOALS	1. DLA: Review global data sources and models for regional daylight variability, find partners 2. Continuation with external funding: Research project for prototyping and testing data pipeline 3. Global vision: Build research consortium to roll out global data products & pipeline
POTENTIAL FOR CHANGE IN DAYLIGHT RESEARCH AND ITS APPLICATION	Architects and urban planners will produce videos with realistic daylight conditions. Ecologists will realistically model the variability of photosynthesis rates in diverse ecosystems using standard data pipelines. Medical specialists will get daylight information for their patients via 2-3 clicks on a web platform.
DISCIPLINES NEEDED	• Physics, meteorologists, data scientists, remote sensing • Architects, urban planners • Terrestrial, aquatic ecologists, plant scientists, • Medical professionals
OUTPUT AND DISSEMINATION	Scientific conferences, journals; Open science platforms – GitHub – Special web platform; Strategic partners – ESA, NASA, WMO, WHO ...
TIMELINE	Goal 1 with DLA – 1 year, Goals 2 & 3 with external funds: 5+ years
LEAD	
BUDGET (can be defined afterwards)	

NEXT STEPS **To be discussed at the last break out session (Friday November 20, CET 16:45-17:45)**	• Formal step: one-pager proposal of the topic including a budget to be submitted to the Steering Committee by January 10, 2021 • ...

==========

NOTES FROM FIRST ROUND OF CONVERSATIONS (Nov 19th):

…. Write here …
It is very broad, might have data available, radiation input

- Information to combine, e.g. global dimming, brightening related to aerosol
- Affects spectral and how deep it penetrate, affect ecosystems productivity
- Change in spectrum - predicting - cities are affect by angle of the sun
- How effective is your power panel?
- Combine different information in one place
- Michael: past and historic data: can this allow us to predict the future? - shall we develop new models?
- Climate change: cloud cover not good to model
- - model to train fusing existing and data with simulations - would help to have more real data
- Christian:Helps photographers and artists - but can this help the economy? Where to buy a house, influence the prices?
- Sound maps exist in switzerland - how accurate do you want to be and what to measure?
- CHristian:Get information from satellites? - can they measure daylight?
- In optical sensing looking at clear sky. There might be cloud cover data and ground based data
- Satelite for crops, canopy, meadows, information on a particular incidense radiation.
- CHristian: what about webcam across the world? -
- Arthur: Problem with calibration, need high-resolution cameras, RGB cameras.
- Use meteorological station: intensity is, some places spectral, network of measurements - need to include modelling
- Slopes south or north - will need to be taken into account.
- Marielle: what to use it for? Then weather stations or satellites can be used, designed illuminance meter, cheap and simple, technological options we have, for what - purpose. Says in architecture they use old models.
- Daylight is very dynamic - average, seasonal, standard.
- Michael: how can such map be used? Think of policy instruments, sonic regulations, into d-maps, into cities for urban planning. We cannot change the

orientationof the buildings - not able to change later - planning purpose index, fitting in with the 3-dimensional frame implemented into a policy frame

- Kirstin: input, WHO for healthy aging environments with google maps they have a selection of cities to have an index - is it a healthy aging environment?
- - what is the average distance to a shop/park - to inform urban planning to put services in.
- - Michael, indexing programming for different groups of people, e.g. depend on floor heights
- No restrictions for the maps use: what about light at night - light pollution?
- Yes, chronobiologists use this for cancer risk, etc.
- Need input for specifics - what is the appropriate scale? What kind of resolution: high for buildings, less for crop
- What data exists and haven't been linked
- What modelling approaches are there?
- Kath: survey to different groups, forests, agricultur, urban, specify needs
- Carlo came in and interested in health spaces - also health spaces without a map
- Carlo: climate change - talk about ventilation and air also through windows
- Some benefit from windows others not - too hot, need air conditioning
- Architectural insight comes from the inside of the building, can we have a patio outside? Regional aspects important
- Arthur: For architects very high resolution, not for the first phase, but a lower resolution map first as global of lower resolution and then maps with higher resolutions, NY, Rio, …
- Michael: interlink works in Sarajevo, in a valley condition, building s are wrongly placed, not enough air, fine dust not brought out, very crucial to inter-relate data and new zoning regulations: case study locations how it relates into specific architectures
- High sunshine areas, Sunlight is a problem,
- Bernhard: Precipitation data are good global data but radiation is missing a gap
- Cajochen: Surveys questions both from people equipped with sensors and measure daylight but also questionnaires
- Michael: bring in the quality of the data
- CHristian: measuring lots of data. Sensors are different, calibration difficult, map more objective, not from individuals. Not too fine-grain the map, same as sound, very dynamic...
- Arthur: let people walk around with the sensors and measure objectively
- Marielle: spectrometer data on highest building, people walking with sensors, with clouds overcast sky ok, but with clear sky is all over the place, with shadows, etc., use with phone, know the app and geolocation and connect to bigger data bases

- Arthur: first measure objectively, then definitely need modelling, can be a city testbed and on global scale much coarser resolution over growing season for crops and plants
- Wrap up: from global to more specific, urban to cities, to individual, fine-scale, need modelling there and then collecting phone data to compare sensor-based data with model, while also have the coarse-resolution for forests, groups and larger areas

Sorting comments into chapters:

What is the gap - what does not exist?

There is nothing combining environment/ecological and human needs - daylight can do this - filling an identified gap in the manuscript 'Green cities project':

- Information to combine, e.g. global dimming, brightening related to aerosol. This affects spectral composition and how deep it penetrate into vegetation/no vegetation and affect ecosystems productivity.
- Change in spectrum cities are affected by angle of the sun.

Good global data of precipitation exists but radiation is missing - a gap.
There are different maps co-existing - e.g. sound/noise maps but none combine different information in one place.

- Climate change: cloud cover not good to model.
- Model to train fusing existing and data with simulations - would help to have more real data.

Past and historic data: can this allow us to predict the future?

- shall we develop new models?
- How effective is your power panel?
- How can this help the economy? Where to buy a house, influence the prices. Sound maps exist in switzerland - how accurate do you want to be and what to measure?
-

Tracking of measurement - quality of data

There might be cloud cover data and ground based data. Satelite data for crops, canopy, meadows, information on a particular incidense radiation exist.
Use meteorological station: intensity is, some places spectral, network of measurements - need to include modelling.

- In architecture they use old models: Weather stations or satellites can be used, have designed illuminance meter, cheap and simple, technological options depending on purpose.

Webcam across the world?

- Problem with calibration, need high-resolution cameras, RGB cameras.

Resolution of data - what is the appropriate scale?

- high resolution needed for architecture
- coarse resolution good for crop and vegetation

Experiences:

- spectrometer data on highest building, people walking with sensors, with clouds overcast sky ok, but with clear sky is all over the place, with shadows, etc., use with phone, know the app and geolocation and connect to bigger data bases

Complementary approach -

First measure objectively, then definitely need modelling, can be a city testbed and on global scale much coarser resolution over growing season for crops and plants.

- Use complementary data collection from Light data base project of ongoing project
- Use knowledge from green cities project and our published gap in knowledge

Application of such atlas

Think of policy instruments: sonic regulations, into d-maps, into cities for urban planning.

- We cannot change the orientation of the buildings - not able to change later - planning purpose index, fitting in with the 3-dimensional frame implemented into a policy frame

WHO for healthy aging environments with google maps they have a selection of cities to have an index - is it a healthy aging environment?

- - what is the average distance to a shop/park - to inform urban planning to put services in.

Indexing programming for different groups of people and greenery combined,

- e.g. trees, facades, indoor windows depend on floor heights
- light at night - light pollution? Chronobiologists use this for cancer risk.
- Insects - spectrum of artificial light

Ways to proceed - great follow up from greenery project

Test- bed:
Interlink works in Sarajevo, in a valley condition, building are wrongly placed, not enough air, fine dust not brought out, very crucial to inter-relate data and new zoning regulations: case study locations how it relates into specific architectures

- High sunshine areas, Sunlight is a problem, shading cooling, urban greenery
- Window coating
- Solar panels on shadings - for cooling and energy collection

Places to look for into LMIC - WHO

==========

NOTES FROM CONVERSATION - DAY 2 (Nov 20th) → Dialogue towards an integration of the different perspectives.

● How can we combine the different perspectives we heard yesterday?

……
Summary by arthur,see page above

Spectrum is altered by canopies, also by cities, find the needs
Closer look into the data out but not always available
Plan a pilot project: light availability, what is altered, and combine with light data base sensor collection from a human being and let them walk through our modelled city, see how much light they get
(Catapult London - stream of people)interest in high resolution, cities more detailed map
Interacting with wind and air quality - climatic aspect

Discussion:

- Linkages between project
- Luc:Outdoor light exposure - how urban area affecting vegetation, how reflection within a city is changing the spectrum and light availability
- Understand the current situation - policy index - state of the art - current lighting where lighting is not sufficiently applied - LED
- Skyscrapers generate shadows
- Where to build and not to build, real estate restriction for certain places

Facades: spectrum for these areas, calculate direct, impact person standing, indirect
LED full spectrum: needed? Can be ignored? Photoreceptor will not differentiate

Noureddine: Lightscape: morphologies in towns measured in streets. Finding huge differences depending on morphologies in terms of quantity, effects for quality, repartition of the city of Biskra, published a paper,not on the net
Making spaces more comfortable

Gathering other views depending on disciplines:
Thomas: what is the purpose - the output
Provide a resource: World Daylight Atlas - integrating humans into ecology
(for biologists and human subjects)

- Light project 2 and 4 - complement

Predicitions

Shiva: Ecological aspects: resources are there but not accessible - bigger dataset
Collect and make it accessible: but problems in context of citizen science - people collect on their computer and to upload to a format that is good

- Managing data is costly

Pilot DLA money - then seed into bigger projects, sources from other funders

Shiva: Buying spectrometers from the money and let pupils in school measure all across the world - inspires other people - pass on the device or they can keep it

Mathias: Program ‘Satelite’ - compare daylight quality within cities - what is the quality index? Daylight autonomy ok but not daylight efficiency. Asked LUC: how to quantify - things we already know. PAR, action spectra available, can be quantifies in that illuminance. Effectivity for biological response can be calculated
Compare on a relative way - what is reachable inone and what in another?

20000 devices across the world - use cameras and phones - location and sorting the by geotracking to the satellite data
Brings awareness to the public - Luc is playing with this -but we build own app with geolocatio etc - but he can help.

Wrap up:
Focused on cities - provisioning of light quality to others - main purpose provide information, but use is up to the users

- Lightscapes - cool thing - high resolution, pilot cities plan, how best to carried out and whom to approach a funder
- Citizen science - information provided that can be cross-validated and calibrated
- Modelling aspects - modelling community - physisists (reflectance, spectra)
- Assimilate data into models - use part of the data to validate the models, doable
- Question? What resolution is needed? 1 sm, 10sm, 25s, 1km...

Complementary with others - people walk around with sensors - for lightscapes combination with personal light perception, combine with topic 2: getting data from them relation to topic 4: uniform measurements - exact information, light quality, cross-linkage to project 3: topics on new technology - in cities - light availability information coming from our Atlas.
Shiva:
Administration / stakeholders: include governmental bodies: how will this be implemented - for example: matching existing in Zurich map, cantons - that results in policies: communes and stakeholders should have access and include these data into eir decisions
What resources do we have already - Thomas university has 30 branches - can be distributed

● What elements need to be kept from this topic?

……