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Decision Support within Complex Urban Operations

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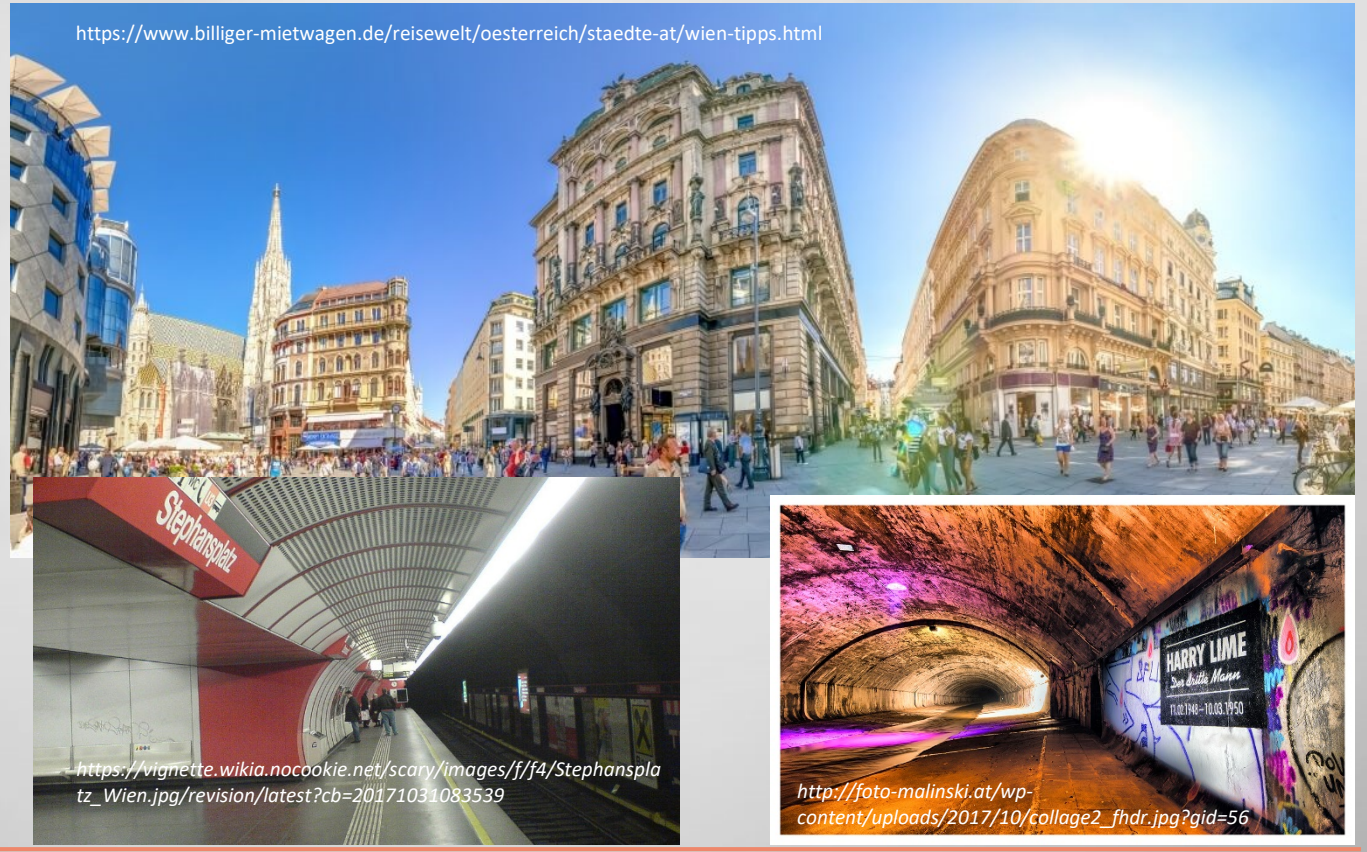
Training versus Reality

Deployment in the urban environment has a priority importance in the development of the capabilities of the AAF as THE operational area of the future. Cross-sectional Concept for Urban Operations, 2021


https://www.militaeraktuell.at/wp-content/uploads/2020/07/50114861583_92aca67cc6_k.jpg



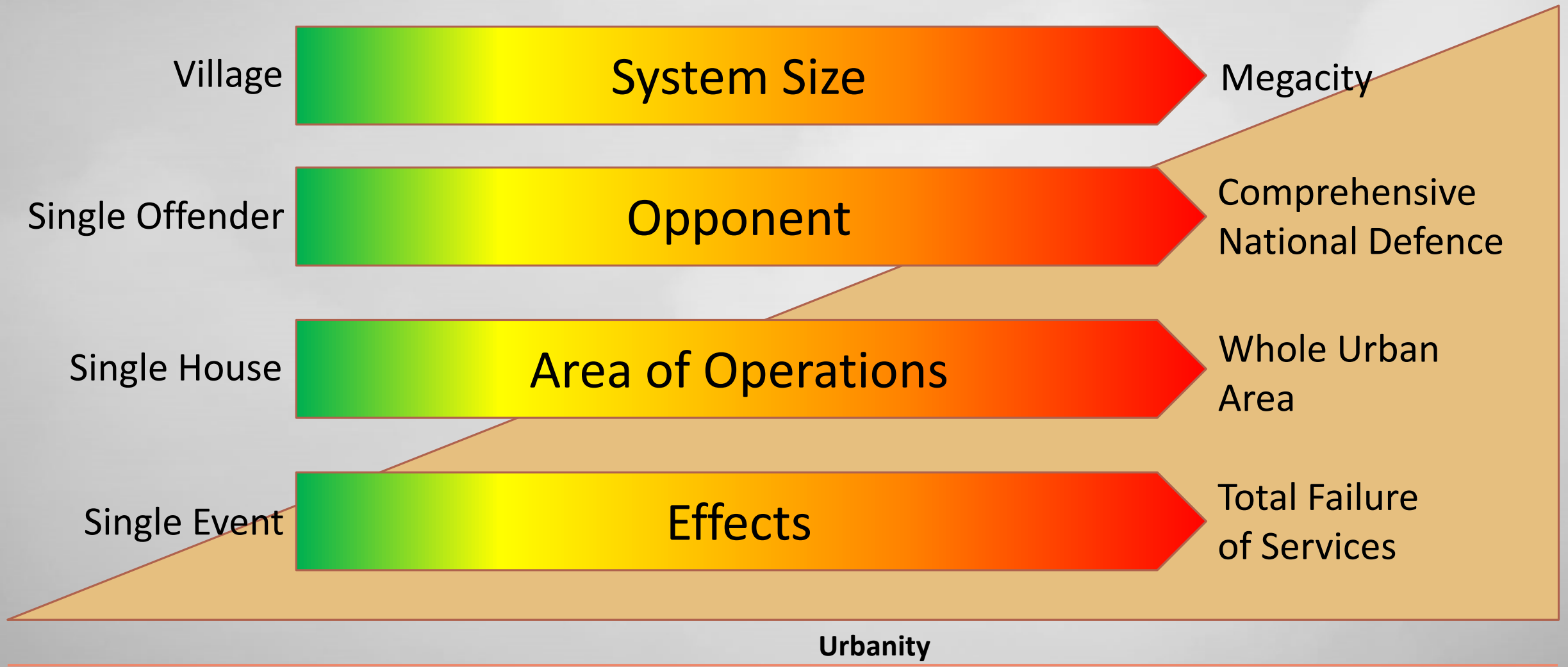
https://www.billiger-mietwagen.de/reisewelt/oesterreich/staedte-at/wien-tipps.html

https://vignette.wikia.nocookie.net/scary/images/f/f4/Stephansplatz_Wien.jpg/revision/latest?cb=20171031083539

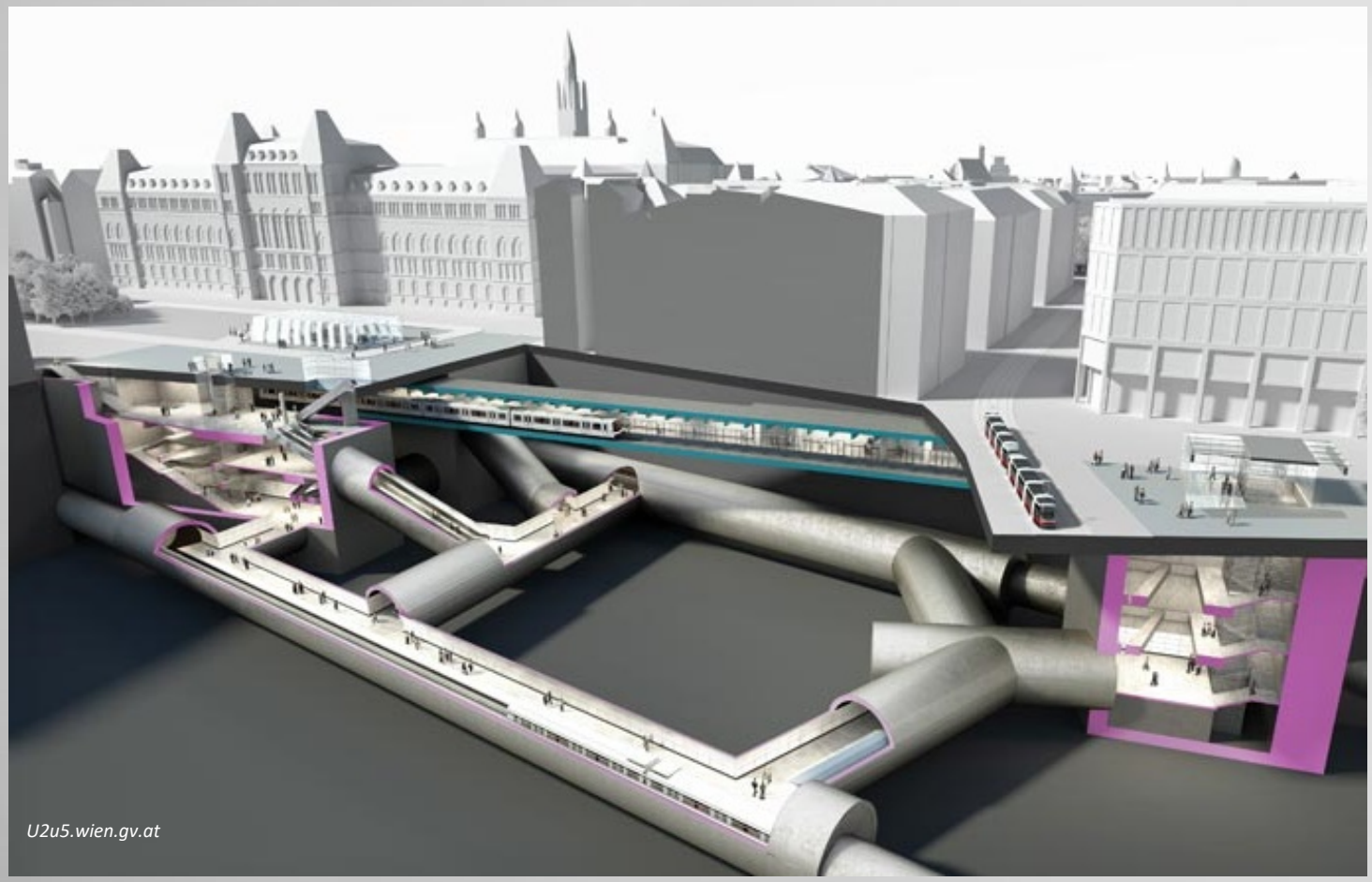
http://foto-malinski.at/wp-content/uploads/2017/10/collage2_fhdr.jpg?gid=56

URBAN means SIZE!

URBAN means COMPLEXITY!



URBAN means TRIPLE-S!



Supersurface

Surface

Subsurface

URBAN in a nut-shell

ÖBH/Pezzi

- Violent opponents and difficult environmental conditions
- Extensive infrastructure on all levels of movement
- Mostly hidden from view
- Comprehensible maps difficult to obtain

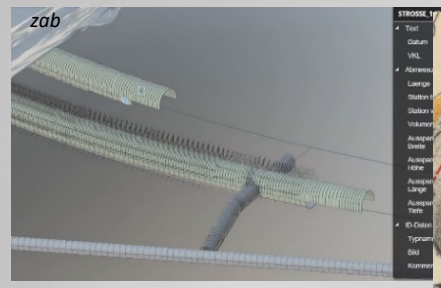
Time Reduction in Digital Decision Support

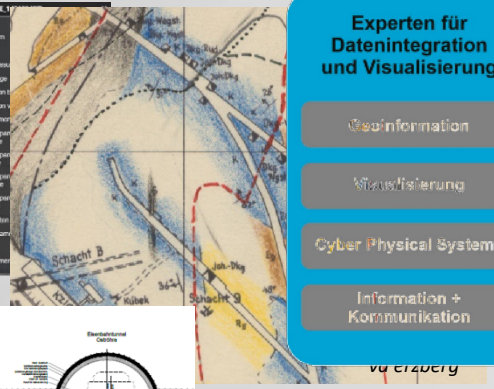
Decision-making process	Total Time	Working Time pen on the map	Working Time digitally assisted	Working Time Reduction
without time pressure	480‘	315‘	220‘	-95‘ (~30%)
with time pressure	120‘	50‘	27‘	-23‘ (46%)

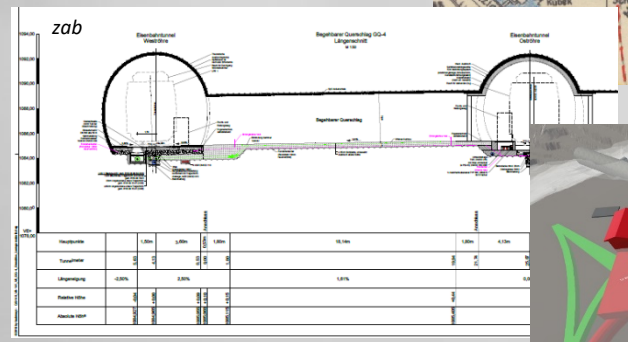
Improvement by two means:
- Visualization and
- Collaboration

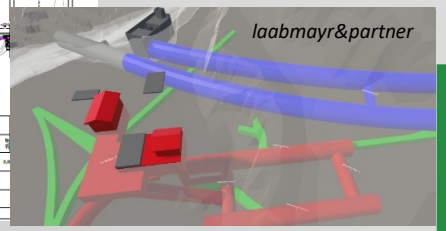
Maximized effect by seamless interaction!

RApid Data Integration and Visualization









Experten für Datenintegration und Visualisierung
- Geoinformation
- Visualisierung
- Cyber Physical Systems
- Information + Kommunikation

Militärische Experten für urbane Einsatzführung
- Einsatzführung urbanes Umfeld
- Kampfunterstützung CBRN
- Pionierunterstützung
- Einsatzunterstützung

Experten Ingenieurwesen

Infrastruktur Obertage
- Hoch- und Tiefbau
- Siedlungswasserbau
- Verkehr
- Städtebau

Infrastruktur Untertage
- Bergbau
- Tunnel- und Untertagebau
- Tunnelsicherheit
- Tunnelbetrieb

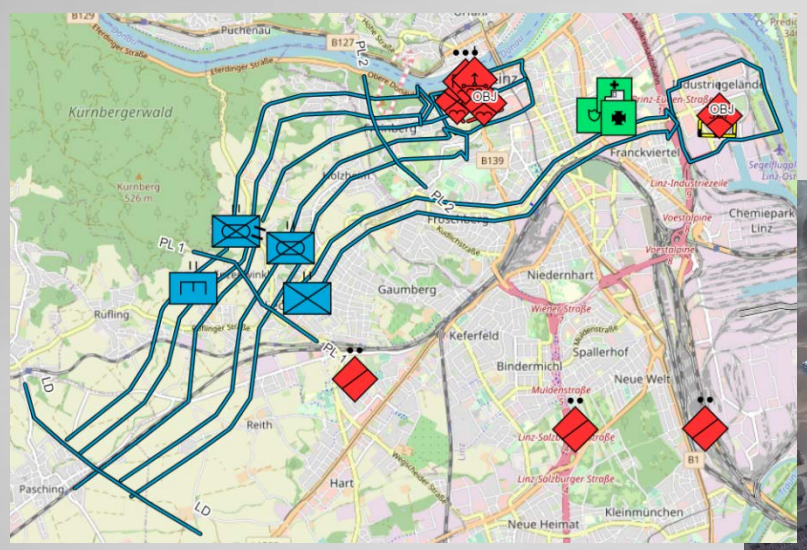
Elektrotechnik, Maschinenbau
Chemie / Physik
Geologie + Geotechnik
Geodäsie

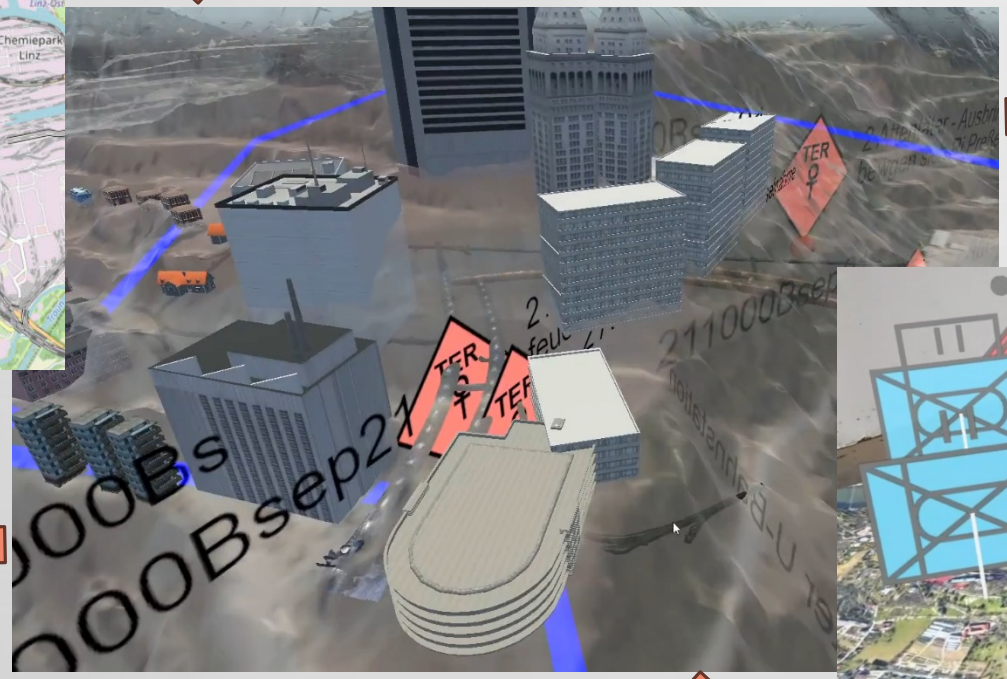
RApid
Data
Integration &
Visualization

y comprehensive (tc)COP

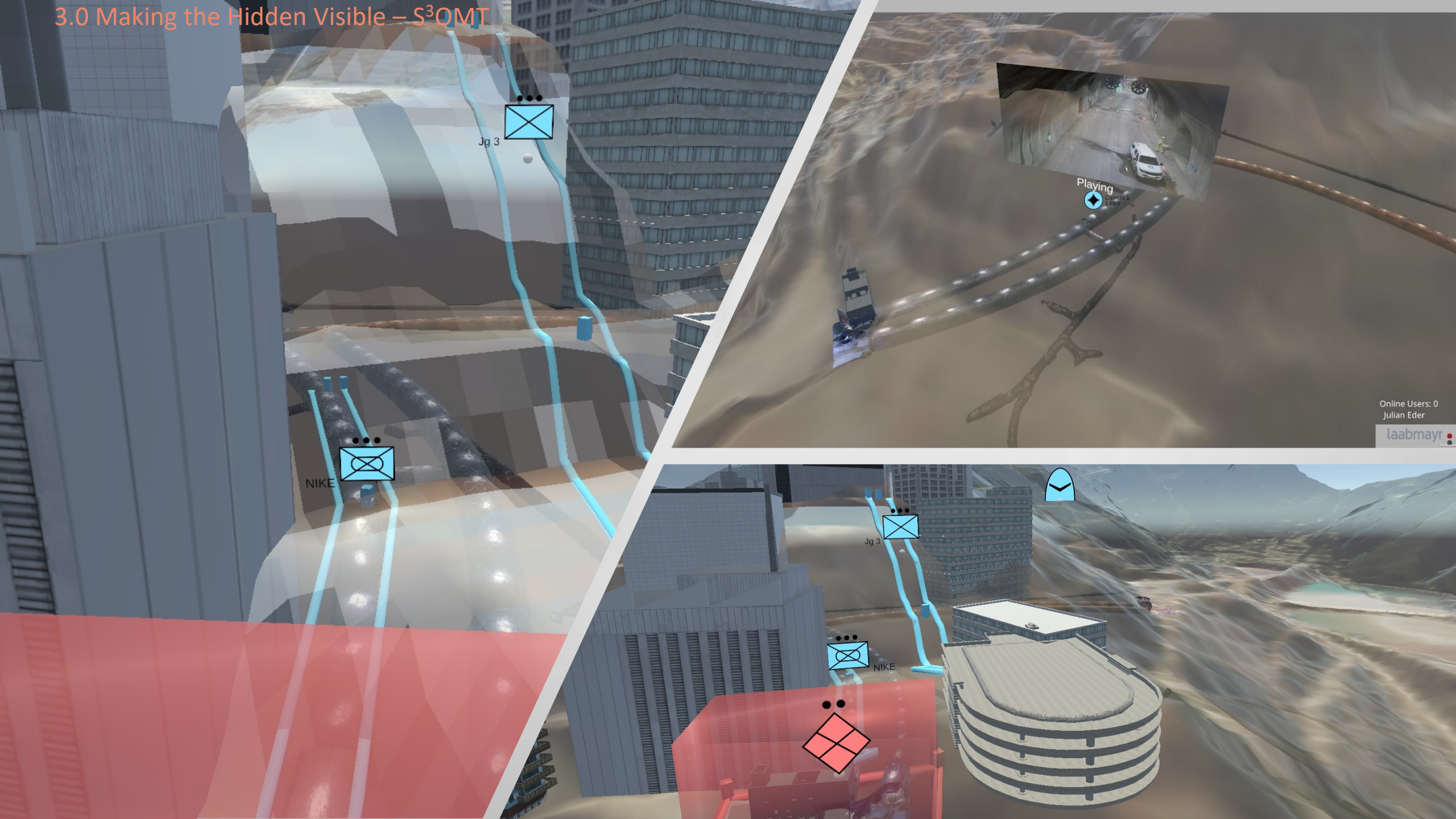
rapid availability
user-friendly and intuitive

Collaboration in virtual environment (S³OMT)

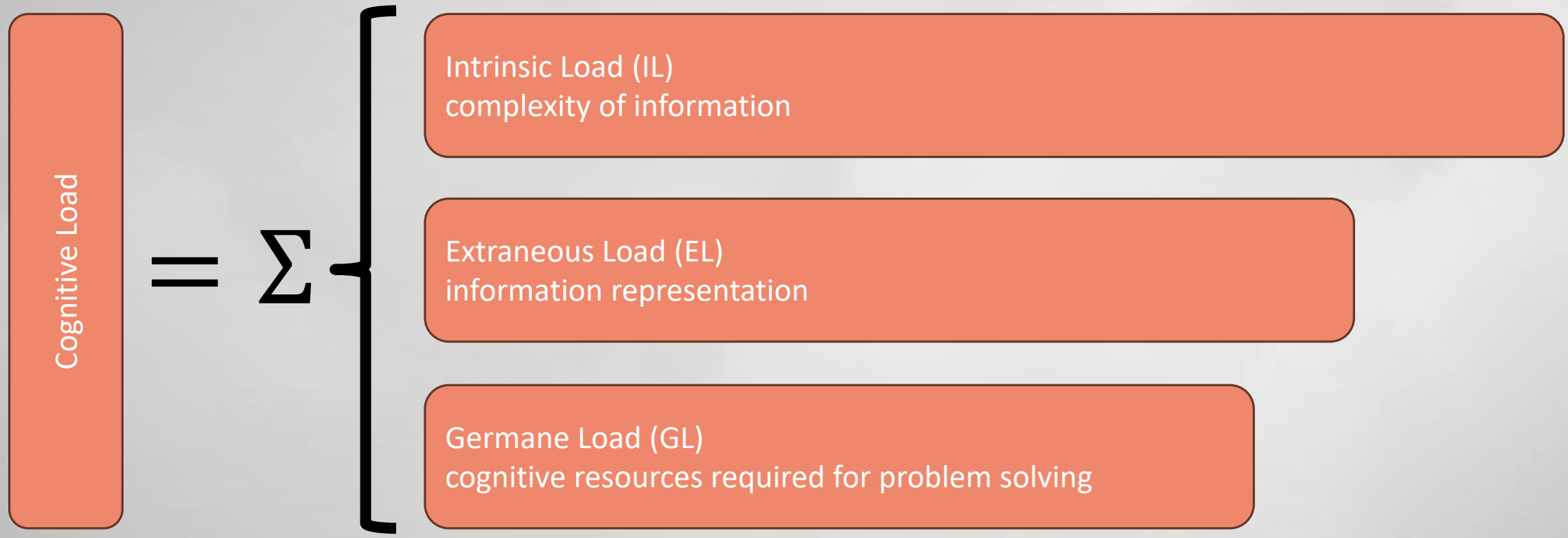




3.0 Making the Hidden Visible – S^{3}OMT



Cognitive Load Theory (Sweller, J.; Ayres, P.; Kalyuga, S., 2011)



Cognitive Load Theory (Sweller, J.; Ayres, P.; Kalyuga, S., 2011)

Cognitive Load $= \sum$

- Intrinsic Load (IL)
  complexity of information
- Extraneous Load (EL)
  information representation
- Germane Load (GL)
  cognitive resources required for problem solving

Goal of digital interfaces: minimize EL, maximize GL thereby also reducing the complexity of IL

Decision-Making in Virtual Reality

- 10 subterranean scenarios
- experimental group: VR, control group: screen
- solution correctness and speed
- not conclusively evaluated yet BUT a high effect of VR on decision-making is already visible
- $t(137) = 5.02$, $p<.001$

Summary

- Visualization will
  - improve the quality of the environmental perception of urban environments
  - reduce the time required to obtain the comprehension of the situation in urban environments
- Improvements in the content production will reduce time
- Decision-making will improve quality-wise, but we must not shorten it (human decision-making responsibility)