computing for a better tomorrow

eCAADe 2018

Education and research in Computer Aided Architectural Design in Europe

Lodz University of Technology

19th - 21st September 2018

Edited by

Anetta Kępczyńska-Walczak

Sebastian Białkowski

eCAADe 2018

Computing for a better tomorrow

Volume 1

Editors
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Faculty of Civil Engineering, Architecture and Environmental Engineering
Lodz University of Technology

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Łódź, Poland
Faculty of Civil Engineering, Architecture
and Environmental Engineering
Lodz University of Technology

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Theme

Computing for a better tomorrow

This is the first volume of the conference proceedings of the 36th eCAADe Conference, held from 19-21 September 2018 at the Faculty of Civil Engineering, Architecture and Environmental Engineering, Lodz University of Technology, Łódź, Poland. Both volumes together contain the 181 accepted papers that are also available digitally in CuminCad (Cumulative Index of Computer Aided Architectural Design, http://papers.cumincad.org/ or http://cumincad.scix.net).

The theme of the 36th eCAADe Conference is Computing for a better tomorrow. When we consider the aims of research activities, design efforts and mastering towards ideal solutions in the area of digital technologies in the built environment, such as CAD, CAM, CAE, BIM, FM, GIS, VR, AR and others, we may realise the actual reason for that is to make life better, healthier, prettier, happier, more sustainable and smarter. The usefulness of undertaken studies might be tested and proved by the noticeable shared approach of putting humans and their environments in a central position: man and the environment, nature and design, art and technology... Natural disasters and climate change, crime and terrorism, disabilities and society ageing - architects, designers and scientists active in the built environment domain are not able to eliminate all the risk, dangers and problems of contemporary world. On the other hand, they have social and moral responsibilities to address human needs and take up this multifaceted challenge. It involves a co-operation and, moreover, an interdisciplinary and user-oriented approach.

The complexity of raised problems should not discourage us, on the contrary, it should stimulate activities towards living up to human dreams of a better and sustainable tomorrow. This calls for a revision of methods and tools applied in research, teaching and practice. Where are we? What are the milestones and roadmaps at the end of the second decade of the 21st century? Do we really take the most of the abundance of accumulated knowledge? Or we skip to explore another undiscovered domains?
We invited academicians, researchers, professionals and students from all over the world to address the multifaceted notions of using **computing** in architectural and related domains for developing **a better tomorrow**. Approaches discussing the theme from the perspective

of computer aided design education; design processes and methods; design tool developments; and novel design applications, as well as real world experiments and case studies were welcomed. In order to specifically address some of the questions above, we defined subthemes and organised specific sessions around these subthemes, during the conference as well as in the proceedings.
Topics included, but were not limited to:

AI for design and built environment
Building Information Modelling
CAAD education
City modelling and GIS
Collaborative and participative design
Design concepts and strategies
Design tools development
Design and structure optimisation
Digital application in construction
Digital design for sustainable buildings
Digital fabrication and robotics
Generative design
Human-computer interaction in design
Information technologies in cultural heritage
Internet of things for built environments
Material studies
Parametric modelling
Shape, form and geometry
Simulation, prediction and evaluation
Smart and responsive design
Smart cities
Spatial reasoning and ontologies
VR, AR and visualisation

The first volume of the proceedings contains 87 papers grouped under 13 sub-themes while the second volume contains 94 papers grouped under 14 sub-themes. In addition to the accepted papers, the first volume is preceded by Keynote papers including keynote speakers contributions concerning the themes of their keynote lectures. Furthermore, it is enriched by special sessions papers and workshop contributions including the papers summarizing the ideas, goals and the content of workshops given.

Anetta Kępczyńska-Walczak
eCAADe 2018 Conference Chair

Acknowledgements

Welcome to the proceedings of the 36th eCAADe Conference and workshops, hosted by the Faculty of Civil Engineering, Architecture and Environmental Engineering at Lodz University of Technology, Poland, 17-21 September 2018. It has been exactly sixteen years since the previous eCAADe conference was held in Poland, organized at Warsaw University of Technology in 2002. We are now very happy to welcome you back to Poland, this time to the very centrally located city of Łódź.

The original idea of bringing the eCAADe conference to Łódź dates back to September 2014 after the eCAADe conference in Newcastle upon Tyne, England. Officially, the eCAADe Council granted us the permission to organize the 36th eCAADe Conference in Łódź in April 2015. Over the last four years several people have helped us to make this conference possible and it is our pleasure to acknowledge and thank them here. First of all, we would like to thank the former Dean of the Faculty of Civil Engineering, Architecture and Environmental Engineering, now the Vice Rector for University Innovations and Development at Lodz University of Technology, Professor Dariusz Gawin and the present Dean of the Faculty of Civil Engineering, Architecture and Environmental Engineering at Lodz University of Technology, Professor Marek Lefik for their positive and supportive attitude.
Secondly, we would like to thank the eCAADe Council, whose members have helped us with various aspects of the organizing. We warmly thank three following Presidents: Johan Verbeke (passed away in 2017), Joachim Kieferle and Tadeja Zupancic.
We thank especially Bob Martens for always kindly and promptly guiding us through the multistage arrangement process of the conference.
Furthermore, special thanks should go to the previous eCAADe organisers, Antonio Fioravanti and his team and Aulikki Herneoja for sharing their experience and knowledge.

Quality control is the vital issue concerning publishing of the conference proceedings. It was a requirement that abstracts were strictly anonymous and avoided any affiliations. To guarantee a high quality of submissions, additional formal checking had been provided before the reviewing process started. Thanks to eCAADe Council we were able to use the OpenConf system for abstracts submissions and reviewing process. Authors uploaded their extended abstracts (length of 1000 to 1500 words plus 5-10 references and one optional image) for the double blind peer review process. Each abstract was evaluated by three reviewers. With the help of the OpenConf system we could easily ensure anonymity and that none of the reviewers came from the same institution as the authors. In this context, special thanks should go to Martin Winchester and Bob Martens for overlooking the abstract submission system (OpenConf), which is one of the main technical pillars for the preparation of this conference.

Altogether, we received a record number of 340 abstracts from 42 different countries. After the peer review process, 225 papers were accepted for full paper submission. In the end, altogether 181 papers were presented at eCAADe 2018 and published in the proceedings. We are very grateful for all the 128 reviewers from 31 different countries (see the List of Reviewers) for their constructive and thorough comments for each author. We also continued the practice started at eCAADe 2015 conference in Vienna of having all the session chairs to give prospective comments of the papers to evoke the discourse at early stage between the author and session chair for all sessions of the conference. We owe the reviewers and session chairs great gratitude for their commitment and long term contribution to the process until the final paper presentations. Parallel to these prospective comments editorial team gave comments to the authors too.
We thank and congratulate all authors for their hard work and support on using the ProceeDings tool and finalizing their full papers carefully in time. In this last phase of editing full papers we may not thank enough Gabriel Wurzer, Wolfgang E. Lorenz and Ugo Maria Coraglia of the ProceeDings team who enabled us to successfully produce high quality proceedings in time.

We owe great thanks to our Keynote Speakers: Antje Kunze (co-founder and CEO of the ETH-Spin-off CloudCities, Solution Manager for BIM and Smart Cities at Esri Germany), Tom Van Mele (co-Director and Head of Research of the Block Research Group, ETH Zurich), Krzysztof Ingarden (Professor at the Faculty of Architecture and Fine Arts, AFM Krakow University. President of Ingarden & Ewý Architects) and Harlen Miller (Associate Designer and practicing Architect at UNStudio's Amsterdam office, the Lead Coordinator of UNStudio's Computational Knowledge Platform) and their contributions of writing the keynote papers concerning their keynote lecture themes.

The roundtable session and panel sessions are traditional part of the scientific eCAADe event. This year the roundtable topic has focused on "A better tomorrow?" stimulating discussion and addressing the conference theme directly. Special thanks should go to Professor Tom Maver for chairing Round Table and to all panelists (Robert Aish, Urs Hirschberg, Antje Kunze, Harlen Miller and Martijn Stellingwerff). The special panel session was dedicated to Digital

Heritage and we are grateful to Bob Martens – the session moderator and all panelists, Laurent Lescop, Tom Maver and Takehiko Nagakura, for dynamic and fruitful dispute.
Workshops are integral part of eCAADe annual conferences. We pay our gratitude to all workshop organisers for fantastic work and contribution of short papers (see the list of workshops). We are also grateful to Wolfgang Dokonal and the eCAADe Council for organizing the PhD Workshop for young researchers and supporting the grant winners with a subsidy for traveling to Łódź.
All additional activities are highly appreciated added value to the eCAADe conferences.

We would like to express our gratitude for the administrative help in organizing the conference, the eCAADe Council and especially Nele De Meyere. In this respect, special thanks should go to Joanna Konca, the Faculty Accountant, and Oliwia Łuczak for helping with financial issues.
As the eCAADe 2018 Conference Chair, I had support from the Organising Committee, especially Sebastian Białkowski, Mateusz Pankiewicz and Bartosz M. Walczak. I further want to give my thanks to Professor Piotr Liczberski, Dean of the Faculty of Technical Physics, Information Technology and Applied Mathematics, Lodz University of Technology, for co-operation in organising the place for the venue.

Organizing an international conference of this scale requires a lot of effort, also financially. Without our sponsors – Autodesk Inc., GRAPHISOFT SE, Vectorworks and Bentley Systems Inc., we would not have been able to offer the conference participants the level of quality that they have got used to at eCAADe conferences. As a special form of sponsorship, the members of the local conference staff donated their time to help prepare and organize this conference. Finally, I would like to thank all students – volunteers who assisted us at the final stage of organising the eCAADe 2018 and during the event.

Thank you all for helping us out.

Łódź, 1st September 2018

Anetta Kępczyńska-Walczak
eCAADe 2018 Conference Chair

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Contents

Contextual Capabilities Meet Human Behaviour

Round the peg and square the hole

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To improve environmental wellbeing and productivity, design innovation focuses on human's use-process, evolving individual space to flexible and specialized ones, according to the users` tasks - activity-based. BIM models supports sophisticated behaviours' simulation such as energy, acoustics, although it is not able to manage space use-processes. The present paper rather than a report of a case study or the presentation of a new methodology wants to contribute, together with previous works, in sketching a theroretical framework within which it is possible to compute the interaction between users and spaces (and vice versa). The quest is to reflect on possible paths for engineering knowledge and understanding, providing a BIM system the semantic information required to operate adaptively and achieve robust and innovative goal-directed behavior. Compared to current research on simulation systems, this research approach links Context, intended as spaces capabilities to Actor's Behavioural Knowledge including formalization of personality typologies and profiled behavioural patterns. By means of a classical problem solving metaphor, the ``squared peg in a round hole'' one, multiple categories for goal achievement are sketched, based on reciprocal Actors and Context behaviour adaptation.

Keywords: *Use-process Knowledge, Behavioural Knowledge, Use Simulation, Cognitive Computing*

INTRODUCTION

To improve environmental wellbeing and productivity, design innovation focuses on human's use-process, evolving individual space to flexible and specialized ones, according to the users' tasks, activity-based. Among available design tools and methods, it has been largely discussed in literature that recent BIM models supports sophisticated building behaviours' simulation such as energy, acoustics, although at the state of the art, this paradigms is not able to manage space use-processes. Researchers are called for studying methods and developing tools to support decision-makers in the built environment modification process - new realisation, refurbishment and change of use, conservation and management - according to humans' operational needs.

Nowadays, the definition of user requirements, a milestone for achieving aforementioned goal, relies on static methods and models, defined a priori by few knowledge engineer. In order to enhance simulation of new/existing artefacts in relation with their potential (re-)use, a good starting point is the development of an acquisition strategy for collecting dynamic data about the users' behaviour related to the context, coming from actual comparable context.

The present 'concept paper' rather than a report of a case study or the presentation of a new methodology wants to contribute, together with previous works, in sketching a framework within which it is possible to compute the - dynamic - interaction between users and spaces (an vice versa). The quest of this research is to reflect on possible paths for engineering knowledge and understanding, providing a BIM system the semantic information required to operate adaptively and achieve robust and innovative goal-directed behavior. Within the research domain, in this paper, by means of a classical problem solving metaphor, the squared peg in a round hole, it is sketched a scenario made of multiple categories for goal achievement, based on the possibilities of adaptation of Actors' and Context behaviour.

ACTORS AND CONTEXT

Actors' presence, both, humans and agents, must be introduced in the actual simulation models for evaluating and enhancing the environment ability to host, to support and to address the use-process. The environment does not only cause behaviour, but is also influenced by Actor's behaviour. In a use-oriented approach, Actors' behaviour can be influenced by Context capabilities and viceversa: Context behaviour can be influenced by Actors' capabilities.

Context, intended as a general extension of the physical environment, including non-physical aspects, is where the Actor use-process takes place. Context can be defined by its capabilities, or better by "affordances", intended in a classic way (Gibson, 1979) as parameters of perception-action loop, also involving such complex concepts as history and practice, namely, the evolutionary relationship between Context and Actors. As remarked by Turner (2005) the concept of "affordance" is relatively easy to define, but has proved to be remarkably difficult to engineer.

COGNITIVE VISION OF THE CONTEXT

A fundamental task for modelling a general domain of knowledge related to Actors' behaviour in a Context (and viceversa), is the effective representation of the Actors' cognitive vision of the Context (and viceversa). Since there is no universally-accepted agreement on what "cognition" is, different research communities have developed different perspectives on the matter: artificial intelligence, image processing, developmental psychology, cognitive neuroscience, and others yet in cognitive robotics and autonomous systems theory.

According to Vernon (2006), for narrowing the technical field of quest, the definition of "cognition" and, for our aims, of "cognitive vision" a couple of relevant questions should be addressed:

- How can we engineer knowledge and understanding into a system, providing it with the semantic information required to operate adaptively and achieve robust and innovative goal-directed behaviour?

- Does a cognitive system necessarily have to be embodied (in the sense of being a physical mobile exploratory agent capable of manipulative and social interaction with its environment, including other agents)?

In order to start reflecting on the possible answers, a state of art recognition about cognitive science is required.

COGNITION AND COMPUTERS

Cognitive science has its origins in cybernetics (1943-53), following the first attempts to formalize what had to that point been metaphysical treatments of cognition. The intention of the early cyberneticians was to create a science of mind, based on logic. This initial wave in the development of a science of cognition was followed in 1956 by the development of an approach referred to as cognitivism. Cognitivism asserts that cognition can be defined as computations on symbolic representations, i.e. cognition is information processing: rule-based manipulation of symbols. Much of artificial intelligence research is carried out on the assumption of the correctness of the cognitivist hypothesis. Its counterpart in the study of natural biologically-implemented (e.g. human) cognitive systems is cognitive psychology which uses 'computationally characterizable representations' as the main explanatory tool. According to Vernon (2006) one of the more recent trends in computer vision research in the pursuit of humanlike capability is the coupling of cognition and vision into cognitive computer vision.

Gero (2017), a researcher with a deep CAAD background, aims to extend our understanding of what kinds of knowledge we can expect our computational tools to have and how systems that have a range of kinds of knowledge might perform differently. Gero calls such objective knowledge 'third-person knowledge' in that the person - we can extend to Actor, including humans and agents - who produced the knowledge is not required to be there when that knowledge is used by another person/Actor. 'Third person knowledge' can be distinguished by "first-person knowledge", defining it as the kind of knowledge developed through the interaction of the individual and their world, or, according to our introductive discussion, of the Actor and the Context. Relying on concepts from cognitive science and in particular, a branch called 'situated cognition', we can build computation systems that encode 'first-person' as well as 'third-person knowledge'. Using those concepts we can produce a branch of computing called 'cognitive computing' that is a closer analog to how the mind works than general computing.

APPROACHES TO COGNITION

It is possible to distinguish essentially two approaches to cognition (Vernon, 2006):

1. The cognitivist symbolic information processing representational approach;
2. The emergent systems approach (connectionism, dynamical systems, enactive systems).

The one thing that is common to both is the issue of knowledge and thinking. However, each approach takes a very different stance on knowledge.

1. The cognitivist approach: - takes a predominantly static view of knowledge, represented by symbol systems that refer (in a bijective and isomorphic sense) to the physical reality that is external to the cognitive agent; - invokes processes of reasoning on the representations (that have been provided by the perceptual apparatus); - subsequently plans actions in order to achieve programmed goals; - and can be best characterized by the classical perception-reasoning-action cycle.

2. The emergent systems approach: - takes a predominantly dynamic or process view of knowledge, and views it more as a collection of abilities that encapsulate 'how to do' things; - is therefore subservient to the cognitive agent and dependent on the agent and its environmental context; - embraces both short time-scale (reflexive and adaptive) behaviours and longer timescale (deliberative and cognitive) behaviours, with behaviours being predominantly characterized by perceptual-motor skills; - is focussed on the emergence (or appearance) of cognition through the co-development of the agent and its environment in real-time.

A general schema of the state of art is summarized in the Table n.1, where the author identifies attributes of different approaches to Cognition.

There is one other crucial difference between the two approaches. In the cognitivist symbolic information processing representational paradigm, perceptual capacities are configured as a consequence of observations, descriptions, and models of an external designer, or knowledge engineer (i.e. they are fundamentally based in the frame-of-reference of the designer). In the emergent systems paradigm, the perceptual capacities are a consequence of an historic enactive embodied development and, consequently, are dependent on the richness of the motoric interface of the cognitive agent with its world. That is, the action space defines the perceptual space and thus is

Approaches to Cognition			
Cognitivist	**Connectionist**	**Dynamical**	**Enactive**
What is cognition?			
Symbolic computation: rule-based manipulation of symbols	The emergence of global states in a network of simple components	A history of activity that brings forth change and activity	Effective action: history of structural coupling that enacts (brings forth) a world
How does it work?			
Through any device that can manipulate symbols	Through local rules and changes in the connectivity of the elements	Through the self-organizing processes of interconnected sensori-motor subnetworks	Through a network of interconnected elements capable of structural changes
What does a good cognitive system do?			
Represent the stable truths of the real world	Develop emergent properties that yield stable solutions to tasks	Become an active and adaptive part of an ongoing and continually changing world	Become a part of an existing world of meaning (ontogeny) or shape a new one (phylogeny)

Table 1
Attributes of different approaches to cognition (Vernon, 2006)

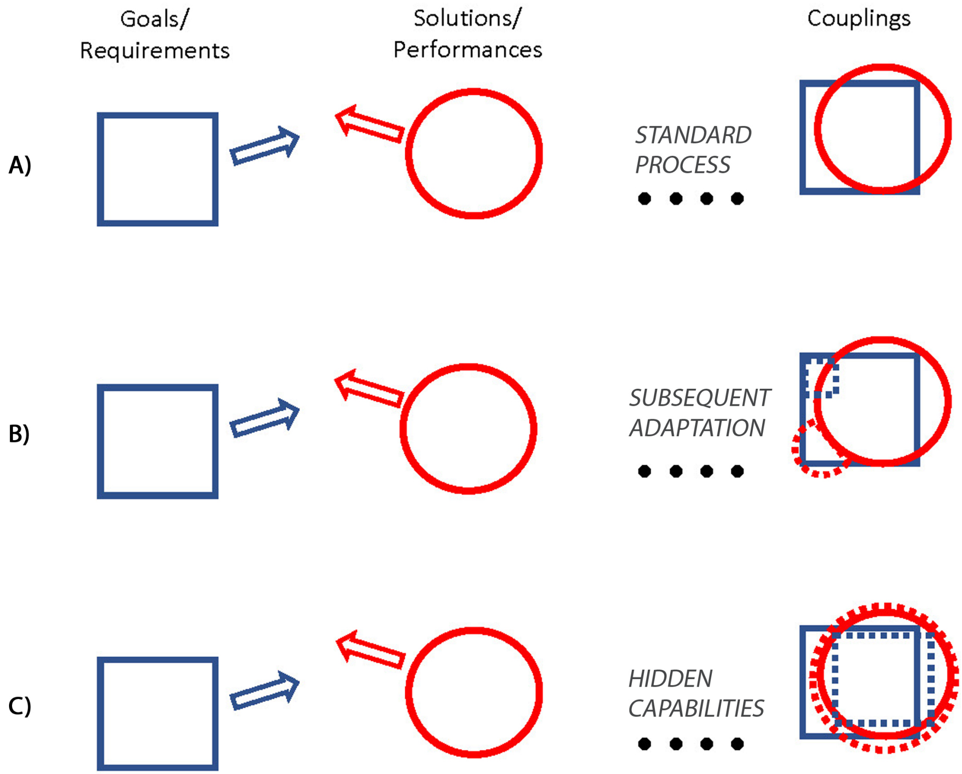
fundamentally based in the frame-of-reference of the agent. A central principle of the enactive emergent approaches is that true cognition can only be created in a developmental agent-centred manner, through interaction, learning, and co-development with the environment.

MODELLING A TRADE OFF BETWEEN CONTEXT AND HUMAN BEHAVIOUR

The innovation is to take into account misused spaces or inappropriate user's behaviour to modify one of them or both to reach the activity goal. The human history - especially the science one - is plenty of overcoming (apparently) impossible goal. The "trial and error" paradigm both in technology and in theory, very often intertwined, as a means to adapt circumstances, tools and goals has been the normality not an exception at different abstraction layers with different granularity. The key concept to resolve deadlocks has frequently been the "adaptation" mechanism.

For instance, the classical problem of "squared peg in a round hole problem" - extending this concept to human satisfaction in a specific environmental situation - can be solved by cutting the peg, or enlarging the hole, or both. Going back to the peg: how can it fit in the hole? Can it be cut? What is the stiffness of material? Are there tools to modify it in

Figure 1
Modelling a trade-off: Subsequent adaptation and hidden capablities



a right manner? What is the cost? How much time should be spent for modifying the initial planned work? What phase is it, the design or the construction one? Authors' identified different trade-off scenarios for design problem solving in the assessment of bidirectional relation between context and human behaviour. On one side based on "squared peg" potentials, intended as the human behaviour adaptation possibilities, and on the other side based on the context capabilities, we outlined the following seven different hypothesis for goal achievement:

1. Hard modification of the "squared peg": rethinking radically the human behavioural convention, in order to fit in the assigned "round hole".
2. Hard modification of the "round hole": reshaping radically the context, in order to accept the adopted behavioural "squared peg" solution.
3. Impossible modification of the "squared peg" OR the "round hole".
4. Soft modification of the "squared peg": re-

shaping the solution, cutting the overflowing edges in order to fit in the assigned "round hole".

5. Hybrid approach: it consists of a soft modification of both, the "squared peg" and the "round hole".
6. Soft modification of the "round hole": enlarging and re-modulating the context in order to consent the "squared peg" behaviour to be admitted.
7. Out of the box scenario: modelling a filter, intended as an "ad hoc" system able to adapt the square peg to the round hole and vice versa.

In order to implement these seven scenarios, and especially for defining the "adaptor", it is necessary to rely on a formal and computable representation of both, Context capabilities - at least physical spaces - and Actors behavioural potentialities.

Additionally, the problem of "squared peg in a round hole" can be seen in a more general point of view as not to simply match performances to needs, but as to have an effective couple among these Aristoteles' categories (or barely architectural components, joints, etc.).

In times there were different academic positions (fig. 1). In A) Carrara, Kalay and Novembri (1994) correctly thought that during the design process both goals and solutions by means of design activity are getting closer, but the iterative process rarely successes and that the initial assumption was that to reach goals resources (the solution) should overcome the minimum requirements with wasting resources.

In B) usually after construction there are two adaptations: from one side improving solution i.e. the building; from the other side, diminishing the goals i.e. the services to patients in a hospital or expectations of visitors in a museum (Simeone 2015).

In C) by introducing the concept of (hidden and more) capabilities (Wurzer 2009) in design solutions and of "real" needs of clients it is possible that the solution it is right for goals without any modification i.e. a fire safety in historical building. These hidden capabilities should be discovered before building construction during the design process by means of machine learning tools and/or trigging accurate simulation programs even in preliminary design phase without waiting constructive phase - according to the principles of proactive design (Fioravanti et al. 2017).

A GENERAL FRAMEWORK FOR BEHAVIOURAL SIMULATION

As previously discussed, situational and contextual factors need to be taken into account for understanding human behaviour. Apart from personality traits, further interpersonal differences are important for explaining and predicting environmental behaviour, e.g. competencies and knowledge, expectancies, value orientations, (environmental) attitudes, personal norms, psychological states (e.g. tiredness, stress, anxiety). Explaining environmental behaviour contemporarily relies, to very large extent, on different concepts than clinical and personality psychology. As value-orientations, attitudes, knowledge and competencies are usually understood as less stable (less deeply rooted in personality) as compared to personality traits, considering these factors opens up possibilities for changing environmental behaviours. In today practice, it can be observed a diffuse pragmatic approach adopted by commercial goods and services industry, based on classification of Personality Typologies. 'Consumer' and 'lifestyle' types use psychological and other features to describe a group of Actors: these are not personality theories or traits in the classical psychological sense, e.g. not stableover lifetime. Such typologies often include consumption pattern and behaviours as a basis for classification. Of course it is required a clear distinction between characteristics used for classification, and related behavioral characteristics, e.g. different variables can be focused on the same or different typologies: demographics, environmental knowledge, environmental concern, norms, activism, shopping motivations, shopping behavior etc.

In order to collect formalized knowledge related to users' profiles, oriented to model phenomenon and process simulations we classified two main methodological categories.

On one side, more traditionally, designers/-knowledge engineers identifies and model use-process requirements, based on 'a priori' operational needs. Experts work on defining space users Personality Typologies by means of structured surveys for outlining differences in the same classes of users approaching the same activities (preferences, value orientation, expectancies, attitudes, etc.).

On the other side, the knowledge source originates by a sort of acquisition strategy, based on a reverse engineering process, capturing data, information and knowledge from real world monitoring, by means of different media technologies (temperature revelator, camera, RFID, Internet of Things, etc.).

The implementation pipeline, according to the currently available technologies, can be developed following this process: Reality -> Big Data Collection -> Data Driven Processing -> Ontology Recognition -> Ontology Population - > Computing Cognition.

It is also important to remark that if we use simulations in a virtual world to predict future events of the real world, we have to reliably represent it, but not be limited by the real world rules.

So, while in the real world only people have the capabilities to think, evaluate the environment and control their behaviour, in the virtual world this task can be assigned to entities, both representing physical or abstract objects, regarding Actors, Context and their interaction.

CONCLUSIONS

This paper reports on theoretical contents and some early implementation patterns developed in the general framework of an on-going research aimed at the definition of a new approach for modelling and testing knowledge related to the users' behaviour in a building environment, oriented to support assistive systems for management and performance simulations.

The definition of two basic concepts eg. Actors and Context has been clarified in order to introduce the actors' cognitive vision of the context. Authors tried to address the reflection on how to engineer knowledge and understanding into a system, by looking at the history of a field of research like cognitive Science and discussing a classification of two main different approaches to cognition: Cognitivist and Emergent Systems.

By means of a classical problem solving metaphor, the "squared peg in a round hole" one, multiple categories for goal achievement are sketched, based on reciprocal Actors and Context behaviour adaptation.

At present the proposed general framework implementation can count on a limited number of building entities formalized by means of current ontology editing systems in order to be used for design reasoning, using the large family of ready-built inference engines and information extraction tools.

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When we consider the aims of research activities, design efforts and mastering towards ideal solutions in the area of digital technologies in the built environment, such as CAD, CAM, CAE, BJM, FM, GIS, VR, AR and others, we may realise the actual reason for that is to make life better, healthier, prettier, happier, more sustainable and smarter.
The usefulness of undertaken studies might be tested and proved by the noticeable shared approach of putting humans and their environments in a central position: man and the environment, nature and design, art and technology...

Natural disasters and climate change, crime and terrorism, disabilities and society ageing - architects, designers and scientists active in the built environment domain are not able to eliminate all the risk, dangers and problems of contemporary world. On the other hand, they have social and moral responsibilities to address human needs and take up this multifaceted challenge. It involves a co-operation and, moreover, an interdisciplinary and user-oriented approach.

The complexity of raised problems should not discourage us, on the contrary, it should stimulate activities towards living up to human dreams of a better and sustainable tomorrow.

This calls for a revision of methods and tools applied in research, teaching and practice. Where are we? What are the milestones and roadmaps at the end of the second decade of the 21st century?

Do we really take the most of the abundance of accumulated knowledge? Or we skip to explore another undiscovered domains?

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