

Applying Advanced ICT Technologies and Augmented Reality To Generate Future Events On The Example of Organisation and Education in Sports

Methodological Assumptions

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Abstract—The article follows up on two research and implementation grants. One focused on the application of mobile ICT systems to improve communication efficiency within the structure of the AZS-AWF Wrocław sports club (e-AZS platform). The other was devoted to the application of the technology of augmented reality to prototype educational trainers as seen on the example of judo. The two projects are to result in the development of original software improving the systems of sports organisation and education. It is assumed that linearity of events means that present effects have their causes solely in events from the past. While this is true, we cannot reject a thesis whereby present events may also result from events located in the future. Weather forecast will never change the weather, but forecasts of stock market trends can and do influence current stock prices in a significant way (after [1]). Thus, one of the new paradigms we can put forward is the thesis saying that future events generated in the information field¹ may be the cause of what is yet to happen. The authors adopt this new paradigm as they explore the areas of sports education and organisation focusing on the specific examples of the sports training process and the organisational system of sports clubs.

Using advanced IT technologies, they have described and explained the methodological basis of the adopted paradigm in the form of a **prototype trainer to be used in martial arts including judo** and the **e-ASZ platform, a tool used in the AZS-AWF Wrocław sports club** to organise training activities. Hence, the paper describes the application of advanced information and communications technologies (ICT) to manage the organisational aspect of the sports club as well as augmented reality as a technology to create a new reality through augmenting its real (augmented reality), virtual (augmented virtuality) and medial (augmented mediality) aspects (research in 2013-2016 and 2015-2017 by the Ministry of Science and Higher Education, supervised by dr hab. Wojciech B. Cieslinski prof. at AWF Wrocław grant numbers: 0014/RS2/2013/52, and dr hab. Kazimierz Witkowski 0011/RS3/2015/53).

Keywords-Augmented Reality Technology (AR), Educational and organisational paradigm, Information and Communications Technology (ICT), organisational space, stretching chains of value

¹By “information field” we mean activities based on planning, forecasting and designing the future outcome.

What follows is a description of fundamental issues related to the subject of our research, namely: organisational space categorised as types of organisational space at football clubs (and other entities) (real, virtual and media); issues related to advanced IT and media technologies including *augmented reality*, *augmented virtuality*, *augmented mediality* and ICT. Next, the paper describes the model of augmenting organisational space as a way to stretch chains of value and generate future events in order to improve the organisational effectiveness of sports clubs and sports education². The studies described below are illustrated by the organisation of the AZS-AWF Wrocław sports club where the research projects devoted to the application of mobile ICT systems and augmented reality were implemented.

The authors assume that both technologies, i.e. advanced, mobile organisation systems and augmented reality. Their integration will help develop organisational models and concepts making it possible to stretch chains of value which may in turn generate precognitions about future events as a source of causes located in the present. In a word, we are trying to see to what extent advanced information technologies can support the organisational system at sports clubs and the ensuing system of sports education generating future events which bear upon events happening at the present moment. We assume that when future events are forecast and planned, present tasks may be carried out more effectively. This approach is more effective than the traditional one where approximations are made on the basis of event linearity (from what was to what is). The non-linear approach to management and organisation (including organisation of the educational activities) may support the processes of prediction which have an impact on what is happening now.

Assumptions behind the non-linear model of managing and organising sports education are presented below.

I. NON-LINEARITY OF EVENTS IN MANAGING ORGANISATIONAL SPACE IN AUGMENTED REALITY AS A TOOL OF STRETCHING CHAINS OF VALUE IN SPORT

Past events are determined by future events. Effects may have a cause in earlier effects. Past events may be an effect of the future. The linearity of events means that past events generate present and future events. Conversely, non-linearity implicates that future events generate present and past events. For example. Combat and/or a fight [for the definition of combat and/or fight see 10] is a non-linear process of behaviours and movement sequences. Future behaviours and movement sequences determine current and present behaviours and movement sequences.

Predicates:

1. Reversed time arrow
2. Precognitions
3. Visualisations of behaviour and movement sequence imitations [4; 7; 9]
4. Master mentality

Episteme:

² Perechuda writes about extending the boundaries of virtual organisation

1. Predicting movement sequences is the way of a master.
2. What will I do now, if the future turns out a certain way, i.e. certain behaviours and movement sequences and the expected combat outcome occur?
3. Events and mental processes are ahead of behaviours and movement sequences to be executed.

Ontology:

1. The ontic essence of combat is prediction – the ability to create future events.
2. Tori-predicting Uke's behaviours and movement sequences.
3. Uke-predicting one's own behaviours and movement sequences.

Methodology:

1. Augmenting reality and visualising it in a non-linear sequence.
2. Superimposing real world images on virtual ones as a process of augmenting the fighter's awareness and imagination.
3. Simulating and modelling behaviours and movement sequences by using AR.
4. Training through augmenting awareness and imagination and generating precognitions through the use of AR.
5. Mental training through augmenting imagination and awareness "here and in the future".

Axiology:

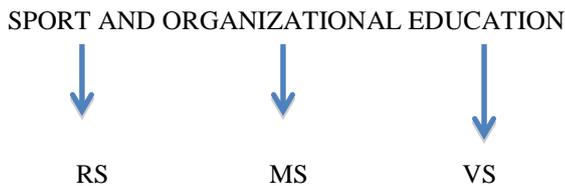
1. The "master mentality" is a value in itself.
2. Visualisations and their augmentation stretches the chains of value that lay the foundations for effective behaviours and movement execution sequences.
3. Combat is a value in itself, nothing is better than learning through combat.

The above assumptions for the educational model using augmented reality are an attempt to describe and explain the potential this kind of technology has to stretch chains of value which is to say generate future events as a factor which has an impact on the activities carried out at present in terms of both organisation and education. What follows is a description of the model of augmented reality as a tool used to generate future events.

II. AUGMENTING REALITY - GENERATING FUTURE EVENTS

By augmenting reality with the use of modern IT technologies we can generate future events. The new paradigm defines a different approach or a novel way of thinking. Thanks to this new perspective, future events generated with the use of modern information technologies (ICT and AR) create events, behaviours and decisions taking place at the present moment. It is possible and desirable to change the approach to organisation and education by understanding that what has happened does not always have an efficient impact on our present actions and decisions. Current organisational space results from events and their permutations, i.e. processes. The events which make up this space may be generated in real, virtual and media space by creating material,

non-material³ and media values respectively. [2]. Space may thus be defined in several dimensions [4] (Fig. 1).



RS- real space, MS-medility space, VS-virtual space

Fig.1.The structure of education in an organisational space
 Source: own study

On the one hand, augmented reality is a technology (augmented reality, virtuality, mediality). On the other, it is a concept opening different ways of mixing reality by using relations between events from public, private and non-governmental organisational spaces. Reality augmentation is in fact a permutation of events where real, electronic and media processes overlap. The idea behind augmented reality is that events in the real dimension are superimposed on events which are generated by computers (virtual events) and/or the media (media events). A reverse process is also possible where events in the virtual and media dimensions are superimposed on real events. Such processes create augmented reality, virtuality and mediality. Based on the assumptions presented above, we may design a mix reality model identifying a matrix of relations between public, private and non-governmental organisational spaces as well as those which are real, virtual and media-related [5].

Organisational space may be augmented by generating future events. We talk of real, virtual or media reality of the organisational space when there are no relations between events taking place in those different domains. If they do interact, however, reality becomes augmented. The next chapter follows up on these assumptions to describe how the mechanisms of augmenting organisational space can be used to stretch chains of value.

III. AUGMENTED REALITY AND ICT AS TOOLS TO GENERATE FUTURE EVENTS

It is assumed that organisational space may be developed in the direction of realspace (real events), cyberspace (virtual events), mediaspace (media events) and augmented reality by applying the technologies of ICT and AR among other measures. In the former case, we are talking about using ICT technologies to create organisational space which is characteristic for its network of information and communication links in the space of an organisation. In the latter case, we are talking about a potential to augment (stretch) the space by superimposing virtual images onto real organisational space as well as superimposing real images onto virtual ones. The above continuum must be supplemented by

³this aspect of market space analysis is described and analysed by Perechuda who points out that in virtual organisations we have virtual chains of value and analyses the boundaries of organisations by combining virtual and real chains of value

media events (tellingly, present-day business organisations develop also in response to facts created by the media in the real <industrial media> and social space <social media>).



AR-augmented reality, AM-Agmedted Mediality, AV-Augmented Virtuality

Fig. 2. Mix reality model in organisational space
 Source: 4.

As it can be seen, real, virtual and media spaces may be augmented with the use of AR, virtuality and mediality. Augmented organisational space has the following features [6]:

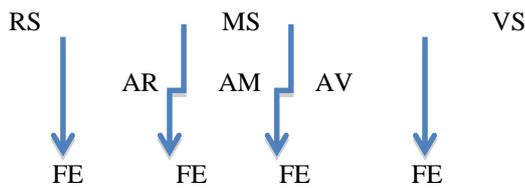
- occurrence of events regardless of the geographical location,
- ability to identify low-signal data,
- ability to identify high-signal data,
- coherence at the meeting point of reality, augmented reality, augmented virtuality and virtual environment [Milgram, Kishino, 1994 Virtuality Continuum, after: 11; 12],
- convergence of processes from real space (industrial media) with processes from virtual space (social media).

According to Ronald Azuma 1997, [after: 11] Augmented Reality is defined as a system fulfilling the following three conditions:

- it combines real and computer generated worlds,
- it is interactive in real time,
- it allows for free movement in three dimensions.

One of the elements stretching the borders of organisational space in the area of value creation is media space. Industrial (traditional) media generate real media facts. When social media are used, we may talk of augmenting media space (augmented mediality) which could create media facts other than just real media facts. A chain of value is a sequence (permutation) of events, actions and processes designed to deliver and/or sell to the customer (including internal customers) a product or service he or she would be ready to pay for. The aim of stretching chains of value is to identify new or modify old products and/or services. Real organisational space generates real events. When treated with AR technology, a real event may create future events and play a part in stretching chains of value by adding virtual (computer generated) or media (generated in the media space) elements. In the case of virtual space, where events are generated by a computer, it can stretch chains of value with the use of augmented virtuality (AV). An event from real and media spaces is superimposed on an event generated by a computer. In the case of media space treated with the technology of augmented mediality (AM)⁴, real and virtual events are both superimposed upon media events (from the industrial and social media).

⁴Augmented mediality (AM) is a technology employed in the social media such as the Internet, mobile technologies or, broadly speaking, communication tools used to blog, chat, twit and engage in other processes of social communication. Such tools are used as part of the practice known as Social Business.



FE- future events

Fig. 3 Stretching chains of value and generating future events

Source: own study

IV. SCENARIOS OF USING AR IN JUDO MENTAL TRAINING – AS THE FIRST STEP IN THE NEW SYSTEM OF ORGANISING SPORTS SPACE

1. Learning kata with AR goggles
 - We record a “masterly” execution of a throw using a kinect
 - We create a mathematical throw model
 - The student, equipped with AR (head-up display) goggles, executes kata in the kinect’s field of view
 - After executing the kata he or she receives a feedback:
 - On whether or not he or she has executed the kata correctly
 - In the case of deviations, differences between the actual and ideal execution are displayed (e.g. the ideal skeleton and the student’s skeleton)
 - The differences are explained using the “coach’s voice” or through a text displayed by the goggles
 - Advice is given on how to improve the student’s kata
2. Learning kata with an interactive floor
 - As in 1 above, but using an interactive floor that displays correct foot positions during kata execution and other feedback information
3. Learning kata with repetitions
 - As in 1 above, but the student is required to repeat a throw several times, which is only approved, if all the repetitions are acceptable
 - After executing a sequence, information is given on which elements of kata execution should be improved and places where errors were made
4. Learning kata with a demonstration
 - As in 1 above, but, before the exercise is performed, the goggles display a “masterly execution” of a throw
 - As in 1 above, but, before the execution, the student’s own best throw executions (from actual fights) are shown
5. Learning selected kata

- Before a fight with fighter X, a collection of throws is selected which in fighter X’s career have proved the best weapon against him
- Before a fight with a given fighter, selected throws are perfected that:
 - have been the most effective in a given fighter’s combat history
 - that are worth being perfected
 - that have been recommended by the coach

6. We record actual fights using a kinect and build referential models on their basis
7. Using AR goggles we present to the fighter before the fight multimedia contents that result in the fighter achieving the optimum level of motivation before the fight.

At the Figure 3 are shown examples of using the technology of augmented reality in sports.



Fig. 3 Examples of using AR in sports

source: www.google.scholar/augmentedrealit accessed 09/2015

Among other things, augmented reality is a way to improve the mediality of TV broadcasts. Potential applications range from illustrating perfect football passes in real time as the match progresses to showing the difference between world record and actual performance in swimming, jumping or track and field sports.

In judo, the technology may be used to improve combat technique and the quality of combat as such by identifying behaviours which are optimal for each sportsman. It is a training element which is imaginative and mental, its aim being to show future events by “imaging” them.

V. SUMMARY - MODELS OF STRETCHING CHAINS OF VALUE AS A PROCESS OF GENERATING FUTURE EVENTS

By augmenting organisational space with the use of social media (*augmented mediality* - AM), we shift tasks generating added value for the organisation from industrial to social media. Today, organisations move fluently between what is real and virtual. Media space serves as an intermediary in the process of augmenting organisational space. The processes generating value happen at the meeting point of real and virtual space. This value is brought about by social media

which may be called *augmented mediality*(AM) by analogy to the AR and AV technologies.

Thus, when stretching chains of value, an important part is played by augmenting organisational space through the technologies and concepts of AR, AM and AV.

Finally, we may define the following models of generating future events (stretching chains of value):

1. The model of generating future events with the use of AR.
2. The model of generating future events with the use of AV.
3. The model of generating future events with the use of AM.

According to the new paradigm described in the article, new technologies create a new kind of reality:

First, organisations operate in three “real” spaces. The real space is a point of reference for virtual space and media space.

- Second, advanced technologies help augment space in real time. It can be augmented with computer generated elements and vice versa – spaces generated by the computer may be augmented with elements of real space.

- Third. The resulting “mix reality” can generate future events, i.e. events related to the process of training, planning and forecasting.

- Fourth. By treating reality with AR (by imposing virtual images onto real organisational space or the other way round) we can model organisational space generating events which may be the result of correct training activities.

- Fifth. Sport is a very good example of how these technologies can be used to predict future states which – through mental processes and imagination – may create future states-events impacting current behaviours and decisions as well as organisational and training processes not only at sports clubs, but also in any other organisation.

- Sixth. Mobile ICT systems enable real time communication. Hence, generated future events offer real time representations of actions, decisions and behaviours taking place in the present.

- Seventh. Modelling organisational space in the process of training (in the context of sports and organisations)⁵

The assumptions presented above follow the theoretical and practical trends of defining organisational borders, the limits of management and the borders of virtual organisations. Regardless of these facts, we are experiencing a quantum leap in technology. Developments in this area are seen in phenomena [3; 8] which have so far been used operationally. Real, virtual and media spaces overlap. We need to look for ways to converge them so that the activities in the real space can be better and more efficient. Future events generated by means of AR, AV or AM may be more tangible than traditional precognition forms which often do not emerge in the information field and, being part of the energy field, are difficult to verify by scientific tools. Perhaps the future lies in studies in the area of cognitive sciences focused on the

convergence of processes from the real, information and energy fields.

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⁵importantly, the notion of training is not related only to sports, but also to organisations and business training. In the case of a sports club, besides regular sports training, we also have managerial training which uses advanced ICT technologies and augmented reality to generate on-line future events offering mental clues to guide present behaviours they inspire and show.