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VIRTUAL REALITY

Cognitive Foundations
Technological Issues
Philosophical Implications

Virtuality in Cognition, Neuroscience & Psychology

Virtual Science:
Virtuality and Knowledge Acquisition in Science and Cognition

Markus F. Peschl and Alexander Riegler

The focus of this paper is the process of knowledge acquisition (KA) and which role virtuality plays in this context. We argue that there are three different modes of knowledge acquisition which can be identified both in the domains of cognition and science: the empirical, the "constructive", and the "synthetic" mode. We show that the method of constructing knowledge in the virtual domain (i.e., the synthetic mode of KA) is not only a principal mode of KA in our cognition (e.g., thought experiments, making plans, etc.). It becomes increasingly important in the field of (natural) science in the form of simulations and virtual experiments. The attempt to find an answer to the question of whether simulation can be an information source for science, and to validate the computational approach in science, leads to a new interpretation of the nature of virtual models. This new perspective renders the problem of "feature extraction" obsolete.

Psychological Perspectives on Virtual Reality

Shulamith Kreitler

The talk provides an analysis of the nature of virtual reality from the point of view of psychology. Virtual reality is considered within the context of cognition, meaning and consciousness. Cognition is presented as a meaning-processed and meaning-processing system, whose contents and processes are determined by its meaning generated organization. The organization of the system of cognition affects cognition and other systems and functions, for example, emotion and the self. Consciousness is considered as reflecting the whole state of cognition at a given time. Reality is a product and function of consciousness. The purpose of the talk is to analyze virtual reality in terms of the meaning system, which would enable characterizing it in a stable theoretically-bound form. The results of prelimiary studies of the nature and experience of virtual reality are presented. The similarity of virtual reality to regular reality is emphasized and the uses of this similarity for research and therapy in the psychological framework are elaborated and illustrated. Finally, the inconsistency and tension between experience and cognition or between the inside and outside views of virtual reality are presented and their impact is illustrated.

Technological Applications & Virtuality

Virtual Reality, Cyberspace and Living Organisms: Towards a New Understanding of Perception and Cognition?

Karl Edlinger

This contribution deals with virtual reality and cyberspace and their implications for human perception and the mind. It can be shown, that concepts and elaboration of virtual reality and cyberspace must be based on well founded and consistent concepts of the latter, although these concepts are not considered explicitly in most cases. So VR and cyberspace open up new aspects of human perception and cognition, which correspond with the theoretical approach of the school of Culturalism to scientific cognition.

Madness & Virtuality: An Approximation

Steffen P. Walz and Isabel Zundel

This talk approximates interrelations between representations of madness, and virtuality in Immersive Virtual Environments semiotically. Thereby, social and sensual performances indicating coded acts of practice are mapped, and investigated from several perspectives. The authors give an introduction to these 'altered states' and investigate the nature of madness in virtuality, and vice versa. Thus, it is suggested that a transgression of physical and mental coded acts of practice challenges our concepts of reality—it may be possible to learn from representations of madness in order to design representations of virtuality, which in turn may be of help to comprehend representations of madness.

The Emotional Talking Virtual Humans

Nadia Magnenat-Thalmann and Sumedha Kshirsagar

Autonomous virtual humans have been of particular interest in last few years. Apart from avatars in shared virtual environments, applications can be found for virtual storyboards, virtual salespersons and assistants. In this talk we discuss the issues involved in the autonomy of such virtual humans and considerations involved in the communication with them. In particular we focus on the emotional aspect of the autonomous virtual humans. We concentrate on the evolution of the emotional state of the virtual actor through dialogue. The implementation of an emotionally autonomous actor and the possibility of conversation are discussed. The personality of an emotional autonomous virtual actor is defined and modeled to help the evolution of emotional state in a dialogue.

Computed Navigation in Cranio-Maxillo-Facial and Oral Head and Neck Surgery: Principles, Indications and Potentials for Telepresence and Teleassistance

Arne Wagner, Werner Millesi, Franz Watzinger, Michael Truppe, Michael Rasse, Georg Enislidis, Christian Kermer and Rolf Ewers

Following recent technical developments in computer-aided surgery, the feasibility of computed navigation assistance in neurosurgery as well as in head and neck surgery has been demonstrated for a wide variety of indications. The principle of intraoperative image guidance is to enable the surgeon to define a procedural task, depict it on-screen in relation to the patient's imaging data, so that the information on individual anatomy and pathology and on the surgical access to treatment can be at hand during the intervention. The "Virtual Patient" oper-

ation system is the first of its kind to enable a transnational network constellation. First, all imaging modalities are set in relation to each other by "image fusion" for an interactive on-screen planning. The depiction of the surgical access path, anatomical landmarks and target structures as overlay graphics on radiologic or on still video images of the patient is followed by the transferral of data to the patient in the registration procedure. During surgery, the planning graphics are superimposed orthotopically on the live video images in real-time. The surgeon simultaneously views the operation site and the graphical planning scheme, which is shown in the micromonitors of his head-up display. In a telepresence/teleconsultation setting, the composite images—live video and overlay planning graphics—can be seen in all communication centers simultaneously. This technique will allow to establish national and international standards of medicine and of surgical procedures in special. In the future, telecommunication will become a major issue in the standardization of global health care. Potential benefits of intraoperative teleconsultation for patient care as well as the impact on economy, education and training of surgeons will have to be evaluated in the course of international projects.

Virtual Reality in Surgery: Between Satisfaction and Stress

Corina Sas, Ronan Reilly and Gregory O'Hare

The present study is focused on usability issues related to laparoscopy, emphasizing the surgeon's overall satisfaction with the mediated perception of reality. We were particularly interested in assessing the differences between this mini-invasive surgical technique and classical surgery, trying to underline both its advantages and limits. We also tried to evaluate the level of stress induced by this method, among the surgeons who use it on a regular basis, together with the adopted coping strategies. Laparoscopy, even though grounded in classical surgery, has its own distinctive features, which require flexibility in order to facilitate the transfer of skills. Despite its limited range of applicability, used discriminatively and carefully, together with well-organized training sessions, this technique can bring satisfaction to both surgeon and patient.

Exploring the Concept of Virtuality: Technological Approaches and Implications from Tele-Education

Chris Stary

What can we expect from virtual-reality systems in the future? Is virtuality becoming a characteristic asset of software systems? In order to find answers to these questions conceptual studies as well as technologies dealing with virtuality have to be reviewed and analyzed. In this contribution virtuality is elaborated, as introduced and used in computer science, both, at the conceptual, and technology level. Examples are drawn from the domain of tele-education. Elements for conceptual frameworks, such as usability principles, addressing not only technological perspectives, but also users, organizations, and social processes are identified. In particular, recent developments, such as learner-centered system design of virtual reality systems, are at the center of discourse. A wider understanding of immersion is proposed, emerging from the traditional interaction features in three-dimensional worlds, and capturing domain knowledge in two-dimensional settings, such as Internet-based collaboration based on hypermedia.

From Reality to "the Real": Using Augmented Virtual Reality for Training

Daniel Mellet d'Huart

This intervention considers virtual reality as a medium. It emphasizes the importance of concepts to support innovative developments and enlarge possible uses of this medium.

Illustrative applications come from the field of vocational training. Regarding what training is

and what its current limitations are, the talk will focus on how virtual reality can enhance vocational training processes. A specific approach of virtual reality for training is proposed: using augmented virtual reality makes training more efficient.

A Framework for Optimising Network Usage for Plausible Distributed Virtual Environments

Ashweeni Kumar Beeharee, Steve Pettifer and Adrian West

Central to the vision of collaborative virtual environments is the ideal of large numbers of geographically dispersed participants interacting within a virtual environment. However, fundamental networking limitations make this feat, at best, a significant research challenge.

A number of approaches have been proposed for overcoming the difficulties of networking bandwidth and latency, each of which has merit for some application domains. In this talk we review these approaches and propose a novel alternative. This unites the low-level strategy of dynamically selecting appropriate transport mechanisms, with a higher-level psychologically motivated design for ranking communications according to their "significance" to the users phenomenological experience. The aim is to present a perceptually smooth and coherent experience of the environment for each participant.

VR and Web Page Support in Civil Engineering Education **(Experience Report)**

Gerardo Silva Chandía

Philosophical Aspects of Virtuality

Virtuality and Plurality

László Ropolyi

A historical and philosophical analysis of the concept of virtuality will be presented. One of the main themes of philosophical thinking has been the identification and the characterization of reality. Since the beginning of this tradition, a special aspect or version of reality has been considered as virtuality. Both reality and virtuality have been explored or constructed by the human senses, emotions, imagination, cognition, manipulation, etc. During the historical development of thinking, there have been two essential turning points, namely, the emergence and the decline of modernity. As a consequence, we can distinguish a premodern, a modern, and a postmodern virtuality (and reality). Characterizing these different versions of reality and virtuality, our analysis will concentrate on the relationships between the different concepts of virtuality, presence, worldliness, and plurality. Applying these ideas to the present virtual reality, its three aspects will be specified.

Bergson’s Virtual Action

Stephen E. Robbins

Bergson left us a conception of virtuality much different than what is understood today. Perception, he stated, is virtual action. This concept was embedded within a holographic framework and within a model that established the relationship between subject and object in terms of time. The invariance structures of Gibson provide the information for driving the action systems and partitioning the environmental field into a virtual subset as Bergson required. When applied to the problem of the brain’s imposition of a scale of time upon the universal field, where the

brain is viewed as a dynamical system, this model reveals relativistic implications demanding a far different conception of perception and action.

(Re)constructing (Virtual) Reality

Andrea Gaugusch

One of the central questions of present-day philosophy concerns the link between “language” and “world”. The aim of this essay is to question this link and its assumptions and to develop a non-dualistic view within the context of “virtual reality”. The utility of such a non-dualism is demonstrated in an interdisciplinary discourse in the context of the epistemology of radical constructivism, in the context of current reflection on “consciousness”, and in the context of the neuroscientific and philosophical question of how it is possible that the on/off-principle of neurones conveys “consciousness of something”.

Virtual Reality: Reflections Of Chances, Changes and Dangers in Communicating Knowledge with the Help of VR–Technologies

Rainer Born

Starting point of my considerations is the contribution of VR (Virtual Reality)-Technologies to the possibilities of “communicating knowledge”. Of special concern is the addressee and consequences concerning our “dealing with/in information” and the consequences for acting on the basis of information. Of central importance are the possibilities of “visualisation” due to the technological possibilities of VR. In the context of computer graphics and the development of so called spread sheets the emphasis was put on the so called man–machine–interface.

Rethinking Boundaries

William Keays

Amidst an unprecedented diversity of artistic modes brought forward by a massive influx of information and communication technology, the notion of interface, the connection between the person and the object, between the real and the virtual, assumes a role of paramount significance. Where once the object, the medium, and the roles of its creator and audience were securely defined, now nothing can be taken for granted. Just as the modes of communication are undergoing a fundamental transformation, so is the nature of the artist. This talk discusses a body of work undertaken by the author that is focused on the boundary between physical and electronic realms while simultaneously raising issues that, due in part to the fundamentally technological nature of the work, challenge conventional notions on the delineation of artistic practice.