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Abstract. Quantum computing offers a radically different paradigm for dealing with information and its processing. This tutorial seeks to serve as a springboard that can inform and motivate entertainment computing researchers to delve into this new and exciting field and investigate novel ways for utilizing quantum-computational concepts in their work both from a theoretical and a practical point of view.

Keywords: Quantum Computing, Quantum Mechanics, Computational Methodologies for Entertainment, Theory and Practice of Entertainment.

1 Introduction

Quantum Computing seeks to develop a radically different paradigm for dealing with the character of information and its processing. This is because it is based on a set of rules governing the behavior of subatomic particles that is fundamentally different from the set of rules governing our everyday experience of the physical world. Contrary to the classical view, in the quantum world particles can be in multiple states at the same time, obey non-local constraints in their behavior, exhibit probabilistic behavior during observation and pose inherent limitations on the amount of knowledge we can have about them. What is more interesting in this case is that there exists a well-defined quantum theory able to accurately capture all the quirkiness of the quantum world. It is only recently that the implications of this theory for computation have become an active area of study and this has led to the development of abstract models for quantum computation with impressive potential. Another promising research area investigates the implications of this theory for the processing of knowledge and the roles it can play in addressing problems in the social sciences.

Entertainment Computing, on the other hand, seeks to develop computational models of entertainment, a task that is significantly complex due, among other reasons, to the difficulty in defining something as 'entertaining'. The problem stems from the fact that entertainment is primarily a phenomenological concept and as such it can be substantiated on an individual basis. Consequently, entertainment lacks the generality of objective properties and relies on subjectivity and context. It is for this reason that Quantum Computing provides an interesting alternative in capturing entertainment since it can deal with notions such as state, uncertainty, contextuality, subjectivity and transformation in completely new and unexplored ways. This tutorial seeks to provide an introduction to this new and exciting computing paradigm and

explore the ways by which its models can provide possible building blocks for the theory and practice of entertainment computing.

2 Objective & Intended Audience

The tutorial will seek to familiarize entertainment computing researchers with recent developments in quantum computing and investigate possible synergies between these two fields. The tutorial is oriented towards entertainment computing researchers with minimal exposure to quantum computing who wish to obtain an overview of the quantum field and try out prototype applications on the intersection between the quantum and the entertainment worlds.

3 Content

Although it might seem idiosyncratic to suggest that quantum theory that deals with the behavior of subatomic particles can be useful in thinking about computational forms of entertainment, we believe that there are very interesting insights to be gained from synergistic interactions between these two research areas. This tutorial will seek to describe in a simplified manner (by keeping the mathematical details to a minimum) the major features of quantum theory that can be relevant to this endeavor and provide references for further study. We will describe basic notions in quantum computing such as quantum state, superposition, entanglement, measurement, dynamics and algorithms. We will then turn our attention to specific examples of how these concepts can be used in the development of entertainment applications. We will present prototypes for games and narrative applications that incorporate elements of quantum behavior in their development and operation. The tutorial will conclude with a discussion of possible ways by which further synergies between quantum and entertainment computing can be pursued.

4 Structure

The tutorial will run for 4 hours. During the first half the participants will get familiarized with essential features of Quantum Mechanics and Quantum Computing. The second half will focus on outlining possible synergies between Quantum and Entertainment Computing and getting a hands-on experience with related applications in these fields. All the material for the tutorial will be available online after the event. The following table summarizes the tutorial structure.

Time	Activity
8:30-9:15	Quantum Mechanics and its postulates
9:30-10:15	Quantum Computing Essentials
10:30-11:15	Drawing Synergies between Entertainment

	and Quantum Computing
11:30-12:15	Experimentation with Quantum Computing Applications in Entertainment
12:15 - …..	Discussion & Conclusions

5 Organizer Details

Nikitas M. Sgouros is a Professor in the Department of Digital Systems at the University of Piraeus, Greece working on Entertainment Computing, Multimedia Systems, Artificial Intelligence and Robotics. He has also been a Director of the M.Sc. in Digital Systems and a Deputy Director of this Department. Prof. Sgouros is the author of more than 60 publications in scientific journals and conferences. He holds a PhD in Computer Science from Northwestern University, USA (1994) a M.Sc. with distinction in Artificial Intelligence from the University of Edinburgh, UK (1990) and a Diploma in EECS from the National Technical University of Athens, Greece (1988).

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