Attention Economy, Curiosity and the Future of E-Learning Systems

Ahmet Subaşı

***Abstract*—**In the age of attention economy the biggest problem is not the accessibility of information but its overabundance. The limitations of attentional resources create a competition among alternative contents. E-learning systems must be adaptive to users' epistemic curiosity characteristics to provide users with content that maximizes satisfaction and therefore increases the effectiveness of the training material. To do that, e-learning systems must take into consideration the dynamics of epistemic curiosity and the growing literature in this field. The paper discusses the method to bridge this gap.

***Keywords*—**Epistemic curiosity, attention economy, e-learning, effective learning, curiosity-adaptive e-learning system

I. INTRODUCTION

In his seminal work *The Sciences of the Artificial* Herbert A. Simon points to a challenge of the Digital Age. Our problem in the 21st century is not the inaccessibility of information but its overabundance. Given this informational overload, the real design problem becomes "not to provide more information to people but to allocate the time they have available for receiving information so that they will get only the information that is most important and relevant to the decisions they will make. The task is not to design information-distributing systems but intelligent information-filtering systems." [1] He calls this new type of economy "attention economy."

We are working in fast-paced business environments and providing the professionals with updated content at the right time and in the right amount always becomes a challenge. Imagine the customer service center environment of a large telecommunications company where thousands of customer representatives are serving millions of customers on a monthly basis. There would be product trainings, soft skills trainings, quality trainings and career trainings that need to be delivered to the representatives. The marketing teams launch new campaigns and products on a regular basis and the information needs to be relayed to the representatives instantly so that they can guide the customer requests accurately. For each of those categories, representatives can be bombarded with the influx of new information while they are expected to keep up with service level commitments with high efficiency work. In such environments the effectiveness of the training programs becomes a real efficiency problem in itself. E-learning is one of the tools that corporations and educational institutions utilize for the fast delivery of content at lower costs. However, effectiveness of e-learning tools is still a problem that needs to be addressed. Gruber, Gelman and Ranganath devised a neuroscientific experiment demonstrating the positive relationship between curiosity and learning [2]. Therefore, one of the ways to maintain effectiveness of e-learning is utilizing the dynamics of epistemic curiosity. This paper will offer a method for such a research agenda starting with a definition and review of epistemic curiosity.

Ahmet Subasi, PhD in Cognitive Sciences, Graduated from Middle East Technical University, Turkey,

II. EPISTEMIC CURIOSITY

Epistemic curiosity is an intrinsic human motivation to know. Artistotle begins his *Metaphysics* with the famous lines: "All men by nature desire to know" [3]. It is intrinsic in the sense that we want to know something without any external rewarding system. We take pleasure in knowing specific items of information regardless of their being useful or mandatory to learn. The motivational nature of curiosity has been discussed extensively. Drive theorists see it as an aversive feeling like hunger that is satisfied by information. Optimal Arousal Theorists see it as an appetitive feeling. Litman's I/D model combines these two models into one model where curiosity has both aversive and appetitive variants [4]. According to this theory, curiosity is aroused appetitively by an interesting piece of information (I-type) and it is also aroused aversively in case of deprivation caused by the awareness of ignorance regarding a specific item of information (D-type). Curiosity motivation has intensity and direction as other motivations. When we are hungry we direct toward food. When we are hungry for knowledge, we direct toward specific items of information. As one of the leading figures of curiosity research from the field of Psychology, Berlyne defines the selectivity problem of curiosity by asking the question of why we select specific items of information within infinite alternatives [5]. Curiosity instigating psychological states and situational determinants have been the subject of extensive research. To reformulate the question we can simply ask "when do we feel informationally deprived such that we feel motivated to obtain this piece of information to remove the unpleasant feelings of ignorance" and "which pieces of information do we perceive as interesting such that we are motivated to keep on enjoying the pleasant feelings instigated by them?" For the D-type curiosity, Berlyne hypothesized a link between epistemic conflict and curiosity

[5]. If the incoming piece of information does not fit into our current knowledge structures, we seek to digest and make sense of it. As another leading figure of curiosity research, Loewenstein suggested the concept of information gap and informational reference point borrowing concepts from decision theory, social psychology and behavioral economics [6]. According to his theory, curiosity is aroused by a perceived gap between what one knows and what one wants to know. For one to become aware of an information gap, he needs to have an informational reference point. We might subjectively feel knowledgeable about a subject until we encounter a reference point that reveals our ignorance. As part of his theory and its empirical conclusions, he posits an inverted U-shaped relationship between the level of information regarding a domain and curiosity. If we know too little or too much about a subject, it is less likely that we will be curious about it. Schmidt and Lahroodi [7] discusses the relationship of interest and curiosity unlike many other researchers who tend to equate these two motivations. They acknowledge that if we are interested in a domain, our curiosity tends to expand to domains that are related to that domain. However, they also acknowledge that curiosity has a degree of independence from interests. This concept is related to serendipity effect discussed within recommendation engine research. There are moments in our lives in which we are taken by a subject we have never heard about in the past. Although this is contrary to general tendencies, there is always a probability for serendipitous tastes. The purpose of this paper is not to provide a full review of epistemic curiosity literature but to establish a basic link between that literature and e-learning research as a first step into a new research agenda.

III. EPISTEMIC CURIOSITY AND E-LEARNING SYSTEMS

Loewenstein is the first researcher that formulated curiosity as an expected utility function [8]. Following his research, Subasi formulates epistemic curiosity as a constrained optimization problem [9]. According to this approach, epistemic curiosity is potentially infinite. In other words, we would desire to know everything given infinite time and resources. Due to limitations of and competition over attentional resources, we necessarily make choices to attain maximum satisfaction by reducing selected cases of information deprivation and enjoying selected cases of explorations related to our interest subjects as well as serendipitous ones. To comprehensively calculate maximum satisfaction, we need a thorough model of the dimensionality of epistemic curiosity. For the purposes of this paper we will focus only on interest versus serendipity and completion versus omission dimensions as offered by Subasi [9].

In a typical e-learning system there are various tutorials with differing content. We call each tutorial as an epistemic (informational) resource. The types of content (such as subtopics, ideas, critical concepts) of each tutorial can also be called epistemic resources that are consumed by users. The users of e-learning systems are often given the choice of selecting among various available resources. However, in the case of overabundance of those resources, the selections are partially haphazard. In such cases, the e-learning system must be smart enough to offer the resources that will maximize the user's epistemic curiosity satisfaction to increase the effectiveness of the learning process. The first step of implementing such a system is designing an ontology for all content types. The system must be capable of analyzing the initial selections of the user to model his curiosity behavior based on those selections. Once the system defines the interest-related choices of the user, the next set of recommended resources will be adapted to that model. In this case, the system will not fulfil its promise if it only presents to the user content related to his interest domains. Since the dimensionality we mentioned in this paper is always a continuum among two poles such as interest versus serendipity. Therefore, the system must be capable of measuring the frequency of the user's interest-dependent choices as opposed to his interest-independent choices to adjust its own calculations. This point is also discussed within recommendation engine research. However, other dimensions of human curiosity are very new to any field of technology. The dimension of completion versus omission is one of them.

Completion/omission dimension is about our subjective perception of completeness regarding a specific domain of information. We can use the metaphor of a puzzle. Some people want to fill a puzzle to its last piece, while some might be satisfied once the overall picture is recognizable in its outlines as discussed by Loewenstein in the context of informational reference point [6]. Some users of e-learning tools will be happy knowing too much about a specific category, while some others will want to switch onto other domains once the outlines of a subject are understood. The second group tends to omit details that the first group values and gets satisfaction from. This dimension can be analyzed through the users' selectivity patterns within an ontology of epistemic resources and can be incorporated into the resource recommendations of the e-learning system through a calculation of the maximum epistemic curiosity satisfaction.

These suggestions can be enriched by the other findings of epistemic curiosity research. As another example, if the e-learning system can interpret user inputs describing the user's epistemic conflicts such as a perceived state of inconsistency between two resources or an incongruous piece of information, it can adapt its recommendations accordingly and present the user with the relevant resources that resolve his epistemic conflicts. Such additional curiosity-adaptive features have the potential to differentiate any e-learning tool in the market and make them much more interactive, efficient, ambient and personalized.

IV. CONCLUSION

The age of attention economy urges businesses to be more efficient in their training efforts. In a world where information

can be the sole factor that distinguishes a successful business from an unsuccessful one, more efficient e-learning tools become a necessity. Research on epistemic curiosity has not extended its influence on research on e-learning and the gap needs to be bridged. The current e-learning theory such as that of Mayer, Moreno and Sweller emphasizes design principles such as coherence, modality and segmenting [10], however curiosity-adaptiveness is still not part of the research agenda. "The recent report from Towards Maturity on the gap between corporate learning and what learners actually want highlights that, when given a choice, learners want mobile, relevant, personalised and self-paced content at a point of need. What they get, is often a little different - with too much emphasis on face-to-face and long courses." [11] Once the collaboration between the two research areas mature, we believe that we will see more effectively personalized and better optimized e-learning tools that meets the needs of the age of attention economy.

REFERENCES

[1] H. Simon, *The Sciences of the Artificial*. Massachusetts: The MIT Press, 1996.

[2] M. J. Gruber, B. D. Gelman, and C. Ranganath, "States of Curiosity Modulate Hippocampus-Dependent Learning via Dopaminergic Circuit (Periodical style)," *Neuron*, vol. 84, issue 2, pp. 486-496, Oct. 2014. https://doi.org/10.1016/j.neuron.2014.08.060

[3] Aristotle, *Metaphysics*. (translated by W. D. Ross), 2015.

[4] J. A. Litman, "Curiosity as a Feeling of Interest and Feeling of Deprivation: The I/D Model of Curiosity (Periodical style)," in *Issues in the Psychology of Motivation*, 2007, pp. 149-156.

[5] D. E. Berlyne, "A Theory of Human Curiosity (Periodical style)," *British Journal of Psychology*, pp. 180-191, 1954. https://doi.org/10.1111/j.2044-8295.1954.tb01243.x

[6] G. Loewenstein, "The Psychology of Curiosity: A Review and Reinterpretation (Periodical style)", *Psychological Bulletin*, pp. 75-98, 1994. https://doi.org/10.1037/0033-2909.116.1.75

[7] F. Schmitt, and R. Lahroodi, "The Epistemic Value of Curiosity (Periodical style)," Educational Theory, vol. 58(2), pp. 125-148, 2008. https://doi.org/10.1111/j.1741-5446.2008.00281.x

[8] G. Loewenstein, *Exotic Preferences: Behavioral Economics and Human Motivation*, Oxford: Oxford University Press, 2007.

[9] A. Subasi, *The Mysterious Point of Epistemic Curiosity (Book style, submitted for publication).*

[10] https://en.wikipedia.org/wiki/E-learning_(theory)#cite_note-19

[11] http://www.kineo.com/us/resources/new-to-elearning/the-benefits-of-elearning

About Author :

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