An Educational Game as an Exercise in Isocratean Rhetoric:
The Design and Implementation of an Electronic Toll and Traffic Management System

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Introduction

In March, 1999, I attended an extremely productive and interesting meeting with members of the Department of Transportation (DOT) group who participated in the actual design and implementation of the EZ-Pass system for the New York State Thruway. The purpose of the meeting was to recreate the design and decision-making process, and the subsequent implementation of the system, with the aim of creating a multimedia educational game. In this paper I propose a framework for a design for the DOT educational module. The direction I have taken is based on several factors:

1. an interpretation of the design and decision-making process a DOT group went through;
2. *The Academy of Electronic Media’s* design process for interactive learning modules (ILMs);
3. management and design heuristics garnered as a practitioner;
4. formal studies in management and design;

5. rhetorical studies, especially classical rhetoric.

The educational modules created by The Academy of Electronic Media provide several levels at which the material is presented, embodying different styles of learning as well as different levels of difficulty and depth. This organization is provided in part to contextualize theory, to provide interest and motivation; to encourage exploration and tinkering; to supply auxiliary material (the handbooks); to provide practice; and to entice the learner to dig deeper into the theory behind the uses of a technology. In this case, the educational content and the levels described are embedded in a larger context, that of a game. The challenges of the game require the player not only to grapple with design and analysis in separate areas of knowledge, but to relate the areas to each other as part of a complex, dynamical system, and to participate in the communication between diverse areas of discourse necessary for decision-making along the way. The game module proposed is a multi-faceted means of learning specific sets of knowledge about an electronic toll and traffic management system, designing with that knowledge, and integrating those designs into a larger system. What is practiced in addition to technical skills are the skills of communication, negotiation, information-gathering, and decision-making in a real-world context.

**The Social Context**

The project under discussion is the design and implementation of a major public transportation system. Matters of public policy, politics, government spending, and service to the millions of citizens who are the end users of the
system are implicit throughout. These factors are the complex human and social environment in which this design and analysis is taking place. In terms of the narrative of the actual development process, these social factors provide the rationale for the system in the first place, the structure within which it was successfully accomplished, and the resources of people and public funds to carry it out. Furthermore, these forces were powerful enough to override the internal design and analysis process in major ways, crucially affecting outcomes at key points. While the educational module will not concern itself with political and social issues per se, an awareness of how these factors inform and impinge on the process must be developed if the game is to relate meaningfully to the real-world processes encountered by the intended users. The complexity and unpredictability inherent in any matter of human affairs is evident in the narrative (case study) told by the participants after the fact. As such, the design of this educational module could be enriched by an awareness of its rhetorical properties. At the top level of the ultimate designers, decision-makers, and implementers, a style of discourse was adopted that allowed decisions and actions to flow among diverse legal and political entities without getting bogged down in endless negotiations between entities operating with different rules. The strength and effectiveness of the group put to the test at a crucial point; that the process survived was attributed in part to the rhetorical effectiveness of the group’s nominal leader. The discourses among the technical, financial, and operational areas, especially during the condensed time-frame of the implementation phase, involved a series of major workability decisions, punctuated by crises from the political arena.
An Isocratean Rhetoric

“For since it is not in the nature of man to attain a science by the possession of which we can know positively what we should do or what we should say, in the next resort I hold that man to be wise who is able by his powers of conjecture to arrive generally at the best course...”

Isocrates

Antidosis

The specific rhetorical awareness I wish to add to this design process comes not from any sort of detailed analysis of rhetorical techniques or even the interesting incidents along the way where the persuasive power of rhetoric was brought to bear. What is most relevant to this design would be an awareness of its rhetorical nature from the viewpoint of an Isocratean rhetoric. This rhetoric could be described as the ability to apply informed and effective judgements to a complex process involving both precise and scientific knowledge production and communication at several levels and the unpredictable forces of human affairs. Most broadly, an Isocratean rhetoric is practical, oriented to real-life situations as opposed to abstract ideals, and always aware of the public good. At the highest level, it can be seen as the ability to develop an appropriate rhetoric for the situation at hand within an evolving process.

Isocrates (436-338 B.C.E.) was a contemporary of Plato, and the leading teacher of rhetoric in Athens. It was Isocrates who taught the most powerful speakers and leaders of that period, and as such set the framework for education
in the cradle of Western civilization. For Isocrates, the good of mankind and service to the community is of prime value and represents ‘the good.’ His truth is always an interested rather than a disinterested truth; factual rather than abstract; human, timely, and situational, as opposed to the otherworldly and eternal absolutes sought by Plato. Philosophy and rhetoric were essentially the same study for Isocrates, and the scope was broad, including all the forms of discourse in which the mind expresses itself. He disdained a handbook approach to learning rhetoric; decisions about human affairs cannot be made in a formulaic fashion. The ‘plug and chug’ method of engineering education would have been anathema; approaching engineering as design for practical and specific uses would have been more to his taste, although the absence of the ethical dimension in discussion of the uses of technology would have been, for Isocrates, a glaring omission. The separation of philosophy from rhetoric, beginning with Plato, and the subsequent development of natural philosophy, leading to what we now term science, caused a widening schism between ethics—a concern for the rightness or wrongness of an action—and the practice of science.

The creation of technologies and the consideration of the effects of their use, are by and large studied by different people, in different departments, on different sides of the college campus. Yet these ethical and political concerns and issues of value are woven throughout the narrative of the design and development of the electronic toll and traffic management system. The list is far-ranging: the safety of drivers and toll collectors at the plazas; the potential loss of jobs to technology; the effect on the stock market of the choice of a technology vendor; and the many decisions on the part of the senior planning group involving the good of any given
individual authority when weighed against the good of the project as a whole. An understanding of the breadth and complexity of the issues involved in the decision-making process of this major public project can be enriched by an appreciation for the scope and intention of an Isocratean rhetoric. The design which follows attempts to embed, in a practical, not theoretical, manner, the perspective of such a rhetoric.

Audience Analysis and Client Goal

The DOT group was not only acting as content providers, but as client. The topic of the users of this educational game was raised at several points. An understanding of who the end user (student) is and the goals of the client relative to that audience will be crucial in our overall design of the game. Understanding the educational purpose of the client for the end user will guide us in making both form and content decisions at the beginning and along the way, as we decide what’s in and what’s outside of the scope of this module. Audience analysis is also critical in assessing the level at which any material is to be taught.

My understanding from the meeting is that our audience is DOT employees holding decision-making power at various levels, i.e. managers, as opposed to technicians. One specific statement of goal was to this effect: “We want them to be able to evaluate proposals (vendors especially) and make the right decisions.” The decision-making process of the Independent Authorities Group (IAG) over the years of the development of the transportation system provided the plot to the narrative told in our content-development meeting. The dramatic climax of the narrative was the decision about which technology to use and which vendor to
contract. This decision is arrived at through a series of actions and data-generating analyses from the sub-committees of finance, technical analysis, and operations.

I extrapolate from the client’s identification of the audience as mid-management level decision-makers, their broad educational goal for them to make more informed and wiser decisions, and from the main plot action and dramatic climax of the story that our group told, that decision-making, as a complex, multi-leveled process is the main theme of the game. The design and analysis from three main areas, technical, operations, and finance, provides the content of the educational experience. The design and implementation of an innovative electronic toll and traffic system is what gives purpose and a goal to the body of the story as a whole. The happy ending is the system up and running, more successful than projected (from a number of users viewpoint) and the great plot twist where even the ‘loser’ vendor stays in the game and becomes a winner.

In summary,

**Audience:** DOT middle management decision-makers in multiple departments.

**Client Goal:** increased decision-making ability.

**Educational Content:** financial, technical, and operational specialist knowledge

**Narrative theme:** a major decision, enriched by the complexity of interlocking sub-decisions.

**Challenge of Game:** Non-specialists’ need to understand enough special (technical) knowledge from several areas and to see their inter-relationships, in order to make informed decisions that take the big picture into account.
Organization of Content [see Figure 1.]

I am suggesting that the overall framework consist of a game structured on a narrative based on the actual design and implementation of the electronic toll and traffic management system. The story has characters—the people from the various areas of expertise and from the participating Authorities. These characters are involved in a plot that has challenges, conflicts, surprises, subplots, a climax, and a dénouement. The narrative as a whole provides the top level of learning—a management case study.

The milestones on the timeline of this case study are the key decisions made along the way. These decision points are the openings to the sections of the game where in-depth analysis of the technical, financial, and operational components occur. These three main areas of activity are mutually interdependent. Variables in each area affected the other areas in a multitude of ways. Part of the challenge for the player, even while working within a particular area, such as the design of the electronic tag carried by each car, will be to think beyond the specifics of this design to the way the tag will interact with the infrastructure and operation of the toll booths, as well as the data needed by the financial accounting system to charge the toll.

A Systems View

One way of viewing an electronic toll and traffic management system is as a complex communicating system, linking a variety of machines and humans and operating at several levels (analog, digital, sensory, and linguistic) with a variety
of signals, transmitters, and receivers. Signals at different levels interact and must both coordinate and translate with the others. Tollbooth and electronic tag communicate by way of electronic signals—the wireless communication system. These signals are digitized and sent to the financial “back-room” operation, where they are sorted and translated ultimately into human language, arriving at the user as a bill and at the banks as statements. The signals that pass from the toll plaza infrastructure (in the form of signage and flashing lights) to the eyes of the user are also vital in maintaining a correct and safe traffic flow. Size and strength of signals from the plaza combined with factors of perception and reaction time on the part of the driver must be coordinated with both the human and electronic toll collectors. Changes in traffic flow detected by video cameras are transmitted as video signals. Not only is this video system complex in its own signal reception, processing, transmission, and receipt, but the received signals must be translated and represented in a visual-linguistic form so the data carries meaning to the humans who then make operational decisions about traffic flow.

Identifying the full, multilevel set of connection and translation points in the system as a game activity at the start would build an understanding of the size, complexity, and interdependence of the whole. A choice of how many of these points to include in the game as sub-sections for detailed analysis and design would also highlight the key decision-making points at the level of the system components. The results of those decisions feed upward to the top-level decision-making of the IAG. The electronic toll and traffic management system and its points of communication can be represented in an animation showing the flow of signals at all levels. Developing this animation into an interactive simulation in
which the player can vary conditions at the communication nodes, can lead the player not only to designs for a working system but to an awareness of the interdependent nature of the sub-systems involved.

There is an assumption implicit in this design: that the development of problem-solving, decision-making and design ability will be enhanced by the individual’s ability to establish a systems view of any given situation. Therefore, the view of and interaction with the electronic toll and traffic management system as a system is given priority both in terms of its early introduction in the game, the richness of the simulation, and the centrality of this simulation to the game as a whole. This simulation can be viewed as a world that the IAG is envisioning, designing, testing, and building over the timeline of the game.

**Design of Specific Sub-systems of the Game**

The major individual areas of analysis and design that feed data into the overall decision process are envisioned as 1) technical; 2) financial; and 3) operational. In the case history itself, the first area of concern was with the development and assessment of the technology for the electronic toll system itself. The development of the financial systems for billing the driver and for accounting and distribution of funds between Authorities followed the technical decisions (though these also had a technical component), and the design decisions relating to operations (including infrastructure, personnel, signage, and traffic management at toll plazas) were crammed into a too-short period at the end of the process. The game can show both what really did happen at the case history level, and also permit the user to make improvements on the process.
(improvements needed as viewed in the hindsight of the original planners) by how they communicate within the game and between areas.

Each subsection has the same basic structure. The technical area will be used as an example.

1. **30,000 foot view.** The player begins with a “30,000 foot” view of the area, illustrating the real-world application—cars move through a toll plaza, the problems which the technology aims to solve are demonstrated: traffic congestion, safety of toll collectors, driver satisfaction. The fundamental operation of the electronic system and the technologies involved—wireless communication and video signals—are shown in an animation highlighting the key components and the flow of signals among them.

2. **Design challenge.** The player is given design tasks and expected data outcomes needed by the main decision-making body. The nature of the design tasks will necessitate communication among areas, and part of the game is the answering of the questions posed by other areas. The feedback effect of the external questions is expected to shed light on the internal process of the area queried. For instance, finance may require a piece of data be collected that is impossible to garner with the current technical spec.

3. **Playspace/simulation.** The heart of the technical sub-section is a specific simulation of the wireless communication technology that can be used first to tinker with the system and see the interrelationship of its parts and then to design and test the components involved.
4. **Tutorials.** Beneath the simulation are specific tutorials on the theory (signals and systems, electrical engineering) the player needs in order to understand and design the system.

5. **Handbook.** Accompanying the subsection is a handbook relating to the use, maintenance, and specifications of the system, as well as a glossary of all relevant terms used in the subsection. This handbook is presented in multi-sensory (video, audio and animation) and dynamic as well as textual format. To follow the case history, it might be interesting to develop and test the two competing technologies side by side, duplicating the situation in the case history. The testing in situ could be performed by “plugging in” the systems into the central simulation of the whole system and seeing how they function, confronting the infrastructural issues (placement of devices, velocity of cars) at this point.

6. **Reference database.** A database of reference materials consisting of the kind of information the engineers might research. The data is presented in the form it takes in the real world: charts, tables, catalogues. This database is built to represent answers to the questions that would have to be asked along the design path, and can be constantly improved by feedback from users.

**Multiple Uses for the Game**

The game as outlined can be used in several ways, by a variety of audiences, in multiple venues.

1. First, fulfilling the client intention, the game could be played in the context of a short workshop for transportation managers. Depending on the number of
specialist areas in the game, the number of participants in the workshop, and the facilities of the workshop in terms of the number and networking of computers, the game-play can be structured for teams or individuals representing one or more roles. Teams could be divided throughout the whole group, with cooperation and communication needed between groups, or separate teams could play the whole game, cooperating internally and competing with other groups. In a workshop situation, a level of interactivity can be added where various groups meet and communicate amongst each other along the way, with or without computer mediation. The narrative case history can be strengthened in a live situation where different individuals are given problems and obstacles that must be dealt with in a group context, where rhetorical (in the more limited sense of persuasive) challenges are met, and where events from outside the control of the players can enter at any time. From an Isocatean perspective, this kind of pedagogy utilizes the learning that can be gained from models (the case history) and the learning from practice and experience. The emphasis on this kind of hands-on learning (both in the live and the electronic situation) is implicit in the level of action and interaction built into the game. It should also be noted that, while the overall learning outcome named is an increased decision-making capacity, at no point are handbooks on or specific information taught about decision-making per se. Again, this learning is implicit in the form and playing of the game itself.

2. The game can be used in a variety of academic settings in different disciplines—management, engineering, technical training, communication
and rhetoric studies, decision sciences, and information technology. No matter what the educational focus, the material would be contextualized in a real-world situation. In addition to context, a student from any one discipline would get a feel for the multiple nature of discourses within specialist areas, and the necessity for understanding a variety of discourses at a level that permits meaningful inter-disciplinary discourse in the real world. From an Isocratean perspective, this approach to learning represents a method of healing the communication breaches between disciplines that go back as far as Plato and Aristotle, while preserving the value of specialist knowledge.

3. The game, being electronic, can be designed for deployment in live classroom, workshop, distance learning, or even distance-collaborative modes.

4. The game can be used by an individual or structured for multi-player and/or team uses.

5. The game can be used alone or wrapped in auxiliary educational materials or exercises.

6. The sections of the game can be used modularly, for instance, as a stand-alone management case study, (especially when management students will be dealing with technological matters) for technician training, for financial forecasting (using the spreadsheet and cost-benefit simulations from the finance section).

**Design and Development of the Game**

I would suggest that such a game be designed through rough storyboards by a small group such as The Academy of Electronic Media, then proposed for funding
and developed by an inter-disciplinary group from the academic and professional disciplines mentioned above. It is expected that the original design would undergo refinement with input from the different areas and perspectives. It is further expected that the game of designing and developing such an interdisciplinary game would be a true, Isocratean, i.e. complex and unpredictable, human affair involving competing and cooperating discourses, from which much learning could result for the players.