KEN-KEN SUDOKU WASHING BRAINS?

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UNLOCKING HUMAN DEVELOPMENT

Professor Emeritus Rothkopf makes it E.Z.

In this issue

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THE ACADEMIC ADVENTURER

Dr. Ernst Z. Rothkopf

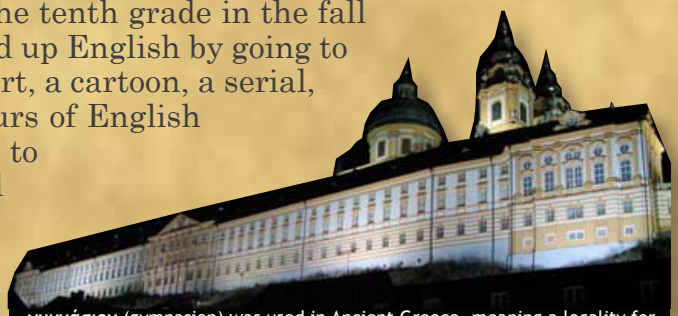
in a Conversation with Michael Swart

Ernst Z. Rothkopf, the Cleveland E. Dodge Professor of Education, Emeritus, has served on the TC faculty in the Departments of Human Development, and Science, Mathematics, and Technology since 1985. He has devoted his entire career in academe and industry to exploring the mysteries of how people learn.

When Rothkopf was born in 1925 in Vienna, Austria, Europe was attempting to recover from the devastation of World War I. As a boy, Rothkopf found escape from the dreary landscape of a stuggling city by devouring book after book, especially those that told of the adventures of explorers of distant lands in South America and Asia. His yearning for adventure took a serious turn as fascism and virulent anti-Semitism sought to dominate the Austrian political scene. For Rothkopf it heralded a harsh change from reading about adventure to experiencing it first hand.

The invasion and occupation of Austria by Hitler's armies in March 1938 resulted in the nation becoming a part of the Nazi Third Reich. The Rothkopf family escaped the deadly Nazi anti-Semitism three months after World War II began by finding berths on an Italian ship sailing out of Genoa. They arrived in New York City on December 6, 1939. Rothkopf's uncle had settled in Connecticut before World War I, and the newcomers followed in his footsteps. Here, their 13-year-old son began the first of his adventures in American education while speaking very little English in a school system quite different from the rigid curriculum of his former Austrian Gymnasium school.

He recalls that he "…spent a few weeks in the seventh grade, then a few weeks in the eighth, then the ninth and ended up starting the tenth grade in the fall of 1940. …I became very interested in Biology. I picked up English by going to movies five times a week—double features, with a short, a cartoon, a serial, and a newsreel. It constituted about 20 pleasant hours of English instruction per week. There was an important lesson to be had: learning does not have to be intentional and one does not have to suffer in order to learn. Sadly, a critical point in learning to speak a new language without accent is whether you arrive before or after puberty. I came just a little too late, and the accent unfortunately remained."



γυμνάσιον (gymnasion) was used in Ancient Greece, meaning a locality for both physical and intellectual education of young men. The latter meaning of intellectual education persisted in German and other languages, whereas in English the meaning of physical education was retained in the word gym. The gymnasium prepares pupils to enter a university for advanced academic study. It starts when you are 10 years old and runs to the age of 18 (4 years of primary school combined with 4 years of secondary school.

Immediately after finishing high school in June 1943, Rothkopf went on to college at Syracuse Univer-

sity. By the spring of 1944, he was drafted for service into the United States Army, in which he served as a forward observer and executive officer in the105 mm field artillery battery of the 88th Infantry Division, notably in the Italian campaigns north of Rome. "After the war ended in May 1945, I managed to get back to Vienna. It was a very strange experience. Here I was not quite six years after I had been forced to leave my first home—and now I returned as one of the victims."

Table of Contents:

After being demobilized as a first lieutenant, Rothkopf returned to Syracuse where he finished his undergraduate work (with one semester at Columbia!) . "I wanted to be a zoology major but there were so many pre-meds in line to register (and the Army had made averse to lines) so I signed up for psychology, specializing in experimental psychology. One of the old professors with whom I studied had been a student of William James—an interesting link with the past for me."

Rothkopf continued his studies at the University of Connecticut where he completed his doctoral dissertation on the role of internal context, especially proprioceptive feedback, in the spacing of practice in rat learning. "I became very interested the work of Clark Hull at Yale who was one of the first to develop a rigorous, quasi-mathematical model of learning. Other psychologists were following in that path, notably Estes, as well as Bush and Mosteller, who were building mathematical models of complex learning.

When Rothkopf completed his Ph.D. in 1952, there was a shortage of job opportunities in the academic market and he took a job in the Personnel and Training Research Center, a laboratory of the U.S. Air Force's Research and Development Command. "The Center was directed by Arthur Melton, an outstanding experimental psychologist, who was then the editor of *The Journal of Experimental Psychology*," Rothkopf recalls. "Melton was a rigorous experimentalist and especially interested in tackling the problem of optimizing human performance. It was an exciting place to be and an exciting time. Bob Gagne and Art Lumsdaine were in the laboratory looking for new ways of applying fundamental psychological findings to applied problems. A whole new field was developing. We were inventing teaching machines and programmed instruction and experimenting with radically new ways of preparing people to handle very complex machinery. Working on these, I became keenly interested in stimulus similarity as a mechanism for determining transfer of training and interference. Can we develop a calculus of practice that will allow us to rationally design lessons that will speed learning? In our lab, we developed similarity measures that later led people like Roger Shepard to perfect multidimensional scaling. It was a very productive time for me and my difficulties in finding a suitable academic job proved to be lucky after all. I worked at AFPTRC in Illinois and then Colorado from 1952 to 1957 and became the head of the Learning and Training Section. The Air Force allowed me to ask fundamental research questions and at the same time got me to thinking realistically about important applications."

In 1957, Rothkopf went on to Rensselaer Polytechnic Institute in Troy, New York as an assistant professor of psychology before being asked by Carl Hovland of Yale whether he would be interested in going to work at Bell Laboratories in Murray Hill, New Jersey. Rothkopf says that "from 1957 until the mid-1980s, Bell Labs was an ideal setting for scientific research where we could pursue any problem that aroused our curiosity. We had abundant resources and were surrounded by some of the brightest minds in mathematics, physics, engineering, and information science. Three Bell Labs scientists won Nobel Prizes. Best of all, these very bright people were willing to talk to each other and to act both as provocateurs and critics. We walked into each others' offices, exchanged ideas freely, and honed them by debating them over numerous cups of tea.

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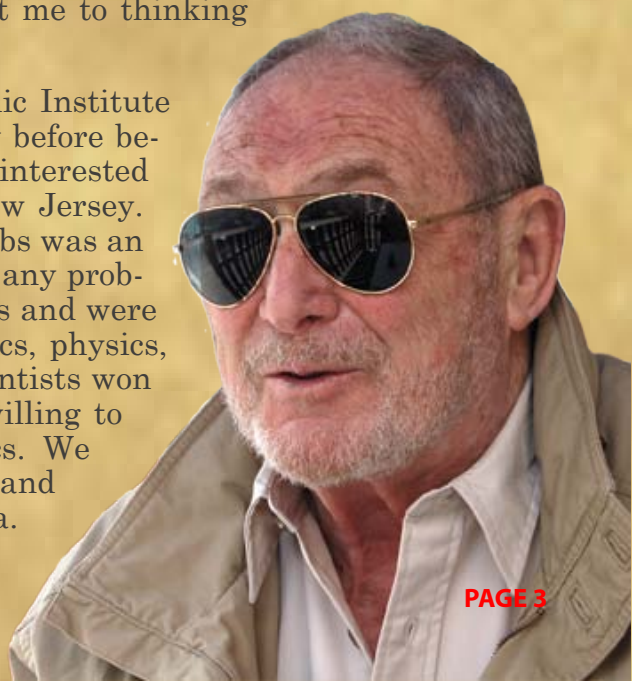


Everyone seemed eager to hear what the others had to say. My colleagues were wonderful people and I learned a lot from them. Two of the current adjunct professors of mathematics at TC –Henry Pollack and Henry Landau—were also researchers at Bell."

Rothkopf has noted that Bell Labs is linked to a parent company, AT&T, that employed and trained thousands. "It was a paradise for learning researchers because ATT maintained the largest training establishment outside the military. It was wonderful way to find out how people acquired useful knowledge." As head of the Learning and Instructional Research Department, Rothkopf was part of the team that developed **multidimensional scaling**, and created empirical methods for perfecting highly effective lessons. "At that time (and it was an important change for me), I decided to shift the emphasis of my own work from calculus of practice studies to greater concern with the student's role in processing instructive stimuli. I called these learning-producing activities mathemagenic activities, from the Greek mathemain (that which is learned) and gneisthos (to give birth)." These are labile activities that determine how instructional material are inspected, processed, and elaborated as well as the student's persistence in doing so. Mathemagenics is about the activities that you engage in learning and how that engagement is maintained." Rothkopf says "You can lead a horse to water but the only water that reaches its stomach is what he drinks." The student determines what becomes the effective stimulus in instruction. This theoretical approach stimulated a wide range of research on the uses of questions, tests, and other student-teacher interactions in shaping mathemagenic behavior. Mathemagenic behavior is adaptive. It can be altered both positively and negatively by teacher interventions and demands. The word mathemagenic, coined by Rothkopf in the mid-60's now yields 22,500 hits in Google.

Multidimensional Scaling
(MDS)
is a set of related statistical techniques often used in information visualization for exploring similarities or dissimilarities in data. A special case of ordination, an MDS algorithm starts with a matrix of item-item similarities, then assigns a location to each item in N-dimensional space, where N is specified a priori. For sufficiently small N, the resulting locations may be displayed in a graph or 3D visualisation.

Respondents are asked a series of questions. For each product pair they are asked to rate similarity (usually on a 7 point Likert scale from very similar to very dissimilar). The first question could be for Coke/Pepsi for example, the next for Coke/Hires rootbeer, the next for Pepsi/Dr Pepper, the next for Dr Pepper/Hires rootbeer, etc. The number of questions is a function of the number of brands and can be calculated as $Q = N(N - 1) / 2$where Q is the number of questions and N is the number of brands. This approach is referred to as the "Perception data : direct approach".

Another line of research developed by Rothkopf at that time was his investigations into how people learn from written text. Rothkopf recalls that, "When I first started in the verbal learning area, there was hardly a study in which people were working with full sentences. Most of them were using words or nonsense syllables. We were among the first to experiment with extensive real texts, like 5200 word excerpts from Rachel Carson's *The Sea Around Us*. Such materials were practically on an astronomic scale for verbal learning.

"Text materials play a tremendously important role in American education and they are often badly designed. Much printed material neglects learning issues and is not designed to aid learning. Just as toy stores seek to appeal to grandparents, so textbooks are frequently configured to appeal to teachers (sometimes even school board members) and not necessarily to learners."

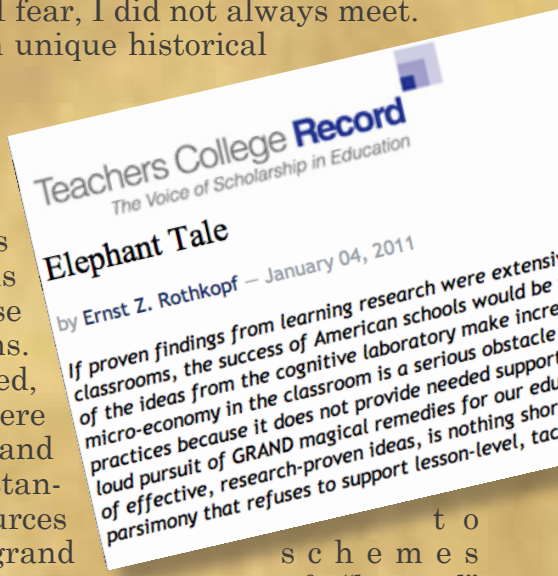
Another reason for working with texts, besides their practical importance, is that they are artificial, tangible systems. Some of the most effective applications of science were with artificial man-made systems or devices such as radar and light bulbs. These materials can be altered by iterative processes such as editing to incorporate findings and principles. This is not easily done by teachers speaking extemporaneously. With a closed artificial system like a text we could become more certain that laboratory findings could be put to work in the classroom. Some of the earliest results of this work were actually announced at Teachers College in the late 60's, when Rothkopf organized a conference, supported by the United States Navy, on verbal learning and effective text design at TC's Greystone House in Riverdale.

In 1985, Rothkopf was called to Teachers College to become the first professor to occupy the Cleveland E. Dodge Chair of Telecommunications and Education. " Coming to Teachers College was very exciting for me. It was here that pioneers like Thorndike and Irving Lorge first gathered and trained students to carry out learning-related educational research using rigorous empirical methods. Rothkopf"s research at TC included a number of experimental explorations of the role of spatial, thematic and environmental context in learning and memory, including the

severe impoverishment of environmental context which occurs when computers are used as instructional tools. He also established an electro-oculographic laboratory in order to continue his work on learning from text, particularly on drifting off , i.e., the loss of attention during reading. Convinced of the mutual benefits of working on both very basic questions and realistic practical problems, he organized a course on learning problems in industrial and other closed systems settings.

He has been trying very hard to persuade people of the merits of national polymorphic computer support for teachers in the most critical school subjects. He sees this as a kind of information utility for schools that includes a wide variety of expositions, explanations, exercises, demonstration, and other related instructional procedures. "Its time we stop running schools like cottage industries and start providing to every student the best available experiences."

Rothkopf says, "I hoped to develop in my students a healthy skepticism because the field of educational research requires it. I wanted to help students to become rigorous, careful experimenters, to cultivate boldness and to seek to apply systematic approaches to research. Teachers College started with a very strong empirical tradition but this constantly needs renewal. Teachers College provided me with many opportunities, which, I fear, I did not always meet. Students and faculty were splendid and the college occupies an unique historical position to influence American education.


Teachers College Record
The Voice of Scholarship in Education

Elephant Tale

by Ernst Z. Rothkopf — January 04, 2011

If proven findings from learning research were extensi
classrooms, the success of American schools would be
of the ideas from the cognitive laboratory make incre
micro-economy in the classroom is a serious obstacle
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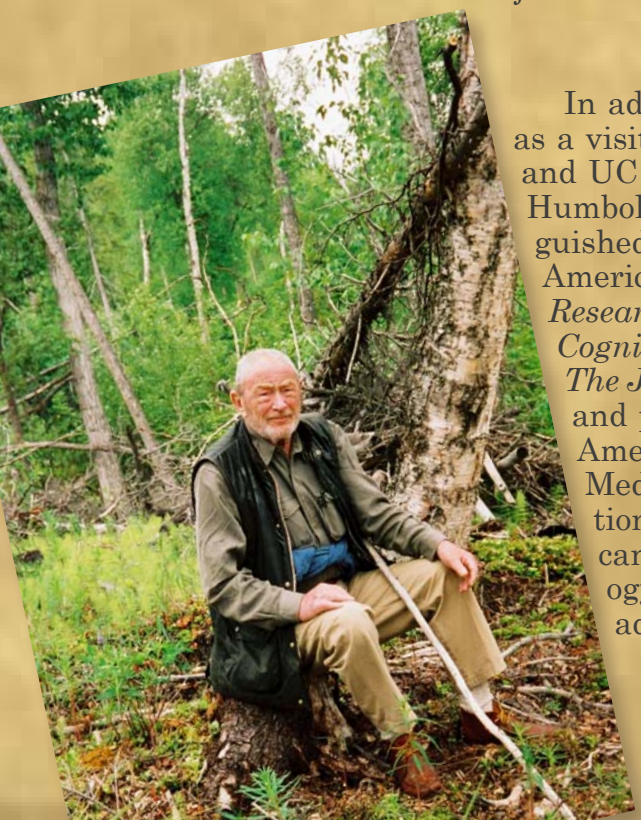
"If I have any regrets, it is that we are a bit too civil about intellectual matters. We may argue about prosaic matters such as space allocation and preference, but in arguments about research and policy we act as if we were afraid to hurt each other's feeling. Both basic science and application thrive on cool analysis and candid debates. And we are much too tolerant of nonsense and cant and even downright deception in educational reforms. We chat about grim deficiencies in American schooling in muted, tranquil voices, barely audible over the clink of our tea cups. Where is the outrage? Cognitive psychology, educational research, and information technology have given us tools that could be of substantial help to teachers right now if we would marshal the resources to use them. Instead we have become preoccupied with elaborate grand schemes spawned mostly in business schools and focused mainly on the management of "laggard" teachers. Recently, Professor Emeritus Rothkopf published a commentary in the TC Record entitled, "Elephant Tale. "Its a diatribe about how people expect solutions. We have a feeling that there is a lot known in cognitive psychology and in the field there is a kind of tension. The Department of Education is looking for the white unicorn in the corner, but others are looking for much more achievable objectives."



In addition to his tenure at Teachers College, Rothkopf taught as a visiting professor at New York University, Rutgers, Stanford, and UC Berkeley, as well as lectured at Goteborg in Sweden and Humboldt University in Berlin. Over the course of his distinguished career, Rothkopf served as president of Division 15 of the American Psychological Association, was editor of the *Review of Research in Education*, and has served on the editorial boards of *Cognition and Instruction, Educational Psychology Review*, and *The Journal of Educational Psychology*. He has edited four books and published over 120 articles. In 1985, he was awarded the American Psychological Association's Edward Lee Thorndike Medal for Distinguished Psychological Contributions to Education. His contributions spanning over five decades have significantly influenced both experimental and educational psychology. We are grateful to build on his legacy and continue the adventure.

Segmenting & Connecting: From Event Perception to Comics

Lecture Report
by Michael Swart

If we can think of the world as a continuous multimodal assault on our senses, then the question becomes, "How do we make sense out of that?" Professor Barbara Tversky attests that we make sense out of it because we really perceive and describe life as discrete chunks—the chunks of life. Borrowing from the philosophers, we first differentiate between **events** and **activities**. An event might be something like a marathon with a beginning, middle and end, or with some type of achievement or accomplishment. An activity, on the other hand, would be the act of running itself.


Professor Tversky

Zacks, Tversky and Iyer studied the perceptions of events and activities by placing stationary cameras in rooms to record people doing everyday tasks. These videos were then shown to people in a laboratory setting and the participants were asked to demark "breakpoints" by clicking a button indicating when one event segment ended and another began. Some participants were also asked to describe (both as coarse description as well as finer level of detail) what they were viewing in each segment as they pressed the button.

Professor Tversky and her colleagues found that there was high agreement among viewers as to where they segmented the boundaries between tasks. Moreover, they found that there was a partonomy struture amongst the boundaries (i.e., the boundaries were hierarchical between tasks and subtasks) and the small units fit nicely within the larger units. For participant's descriptions of what they saw, they predominantly described actions on objects. For example, when describing the activity of making the bed, it was "put on the bottom sheet, put on the top sheet, put on the pillow cases." Participants'

action-on-object segmentations corresponded to other action-on-object segments and these segmentations also aligned with the goals and sub-goals for completing the activity. Additional analysis of the same data using computers (a statistical analysis of the pixel-to-pixel change of each frame) found that the breakpoints indicated by the participants corresponded to the moments of greatest physical change in the frame.

A follow up study by Hard, Tversky and Recchia took still frames from the same videos that corresponded to the segment points and showed them to a new pool of participants. This time researchers were interested to see if observer looking time per slide corresponded to the hierarchial organization of the goals and sub-goals from the previous studies. As expected they did, but Tversky and her colleagues noticed something else. Participants looking times were different between times before and after breakpoints. When they compared this data to the computer analyis of physical change in a frame, they found something interesting: Participants looking times as they approached a breakpoint in a sequence was greater than the physical change indicated by the pixel analysis. So what does this mean? Professor Tversky and her colleagues speculate that the observers' increased looking times were actually responses to subtle cues by the performers in the videos—things like head movements and eye gazes that are indicative of the upcoming starts of new action. For example, when making a peanut butter sandwhich, one starts turning one's head to look for the peanut butter even before finishing the act of splaying both pieces of bread out onto the table.

These studies corroborate observational studies from the 1950's that viewed actions in a naturalistic settings and found that these breakpoints occur with a new action, object, actor, or setting. Essentially, breakpoints link the bottom up information (moments of greatest physical change) with the top down information (completed actions/goals) and allow the viewer to bootstrap inferences between the two. Visual explanations for events and activities allow viewers to process multiple streams of information in parallel.

The usage of pictorial narratives as visual explanations go far back in history. For example, in Egyptian tombs (left), we find pictorial depictions on how to make bread. In modern day, we find these among instructions on how to assemble some of the things we buy (like a new bar-b-que grill that typically has a narrative using diagrams, words and gestures).

A study by Tversky, Suwa, Agrawala, Heiser, Stolte, Hanrahan, Phan, Klingner, Daniel, Lee and Haymaker (2004) found that most assembly instructions also have a nar-

FUN SUDOKU

* Every row includes digits 1 to 9 in any order
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* Every 3 by 3 subsection includes digits 1 to 9

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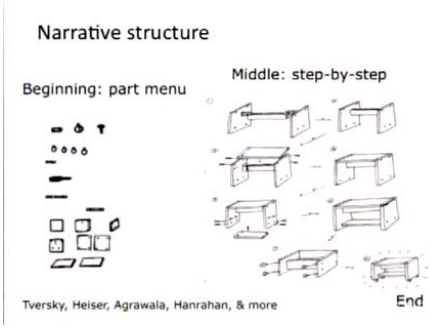
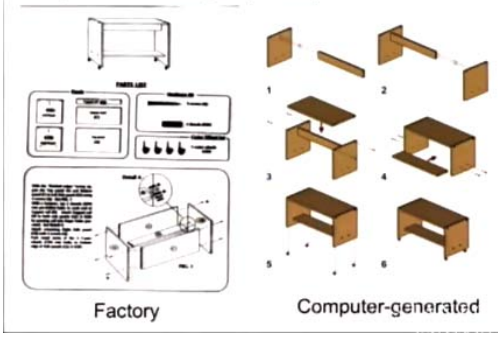


Assemble TV cart using box photo

Explain, using diagrams, words, or gestures

rative structure. Typically, they begin with a part menu, just as a recipe begins with a list of ingredients, and contine with a step-by-step set of actions. In their study, they used instructions for how to put a tv cart together (left). Each new step was a new object or object part much like the way that people segment natural events and use the perspective of action. The researchers embellished their diagrams with arrows and guidelines to help the user formulate the links between the elements that indicated actions. This information was then fed into a computer that generated an algorithm for putting the cart together. They found that these research-based instructions were more effective to low-visuospatial individuals than the original factory instructions.

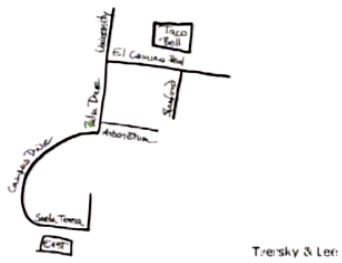
Cognitive design principles



Researchers concluded that cognitive design principles for effective design include showing perspective, perspective of action, and a step-by-step and using arrows and guidelines (right).

Similarly, another study by Tversky and Lee looked at route-mapping. In this study, students were asked to provide directions to Taco Bell using maps or descriptions. They found that the students used either visual or verbal information, consisting of landmarks and paths, where exact directions or distances were relatively inconsequential. As a follow-up, Agrawala and Stolte fed this information into a computer that generated algorithmic path maps that proved more effective for navigation to novices than exact maps. Although the exact maps contained detailed information of the area, the large amounts of superfluous information was more detrimental than beneficial. When students were asked to provide visual explanations for scientific processes, they typically broke up the processes into steps that show changing perspectives and focusing in with mixed both words and pictures.

Routes: landmarks & paths



Linedrive map at mapoint.com

Visual Story-telling

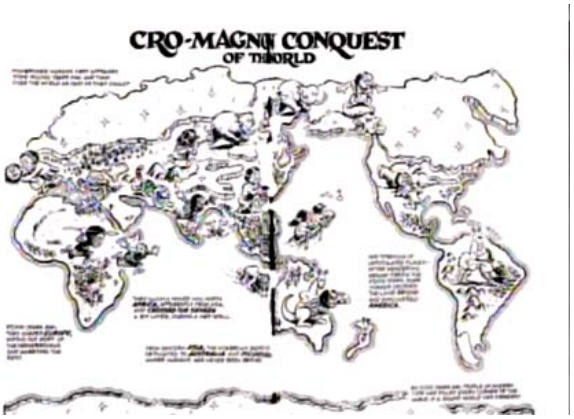
PART II-A: Depicting Events and More In Comics

Moving on to comics, the question becomes, "How do we describe our perceptions and cognitions and weave them together into a narrative or story, and in particular, how do we do this in our depictions?" Typically, the kinds of discourse that we use would be conversations (short interchanges that are usually collaborative), descriptions (emphasizing the structure of things), explanations (causes, behaviors or processes that explain why), arguments (use evidence to make a point) and stories (that necessarily have a narrative voice with

a particular perspective, and can sometimes have with a protagonist and antagonist to convey suspense, drama or emotion).

In comics, Bresman and Tversky investigated the ways that comics create visual narratives that parallel almost any conventions that we convey using language. The first question with comics is, "How do they use space to break up both time and space?" The second is, "What is it in each frame of a comic that conveys that moment in time?" And the third is, "How do we connect those moments to preserve continuity?" One convention is the use of **frames**. Frames go back to Roman and Greek times and essentially provide a window into that moment. Another convention is **grouping**, where like information is clustered together to differentiate time and space.

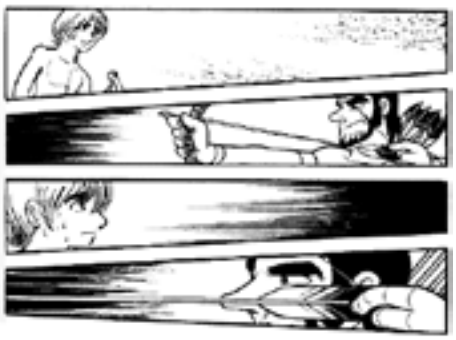
In the example on the previous page, the entire house is present and superimposed on it are actions that happen in time. The same characters appear all over, but the organization (using the convention of left to right) helps us understand that the characters are actually moving to different places over time. Similarly, Gonic uses cartoon maps like the one to the right explain the movement of Cro-Magnon man across the continents and imposes time on space.



Comics also employ frames to maintain perspectives as well as to add perspectives. The comic to the left depicting a walk-n-talk between famous Physicist Richard Feynmen and one of his graduate students shows perspective changes while maintaining continuity.

While some of the devices are similar to **verbal anaphora** (the use of words like *he*, *she*, and *they* to refer back to instances), we can also use visual anaphora to provide continuity over changes in space and time by keeping an element consistent from one frame to the next frame, as depicted in this New Yorker cover entitled "Shelf Life" indicating the life span of a written work from writers desk to the publishing house to fueling a fire (right).

The children's book, *Zoom* (below, left) is another example. Each successive picture going from left to right is zooming outwards. In the first frame we see two children looking out; then we see they are looking out from a barn; then we see the the entire yard; then we see it is actually a toy set that children are playing with, and finally we see that it is actually a picture from the cover of a magazine that a child is reading about a toy set. Recognizing that these types of comics are present in children's literature necessitates that we understand how and when children discern these types of depictions.

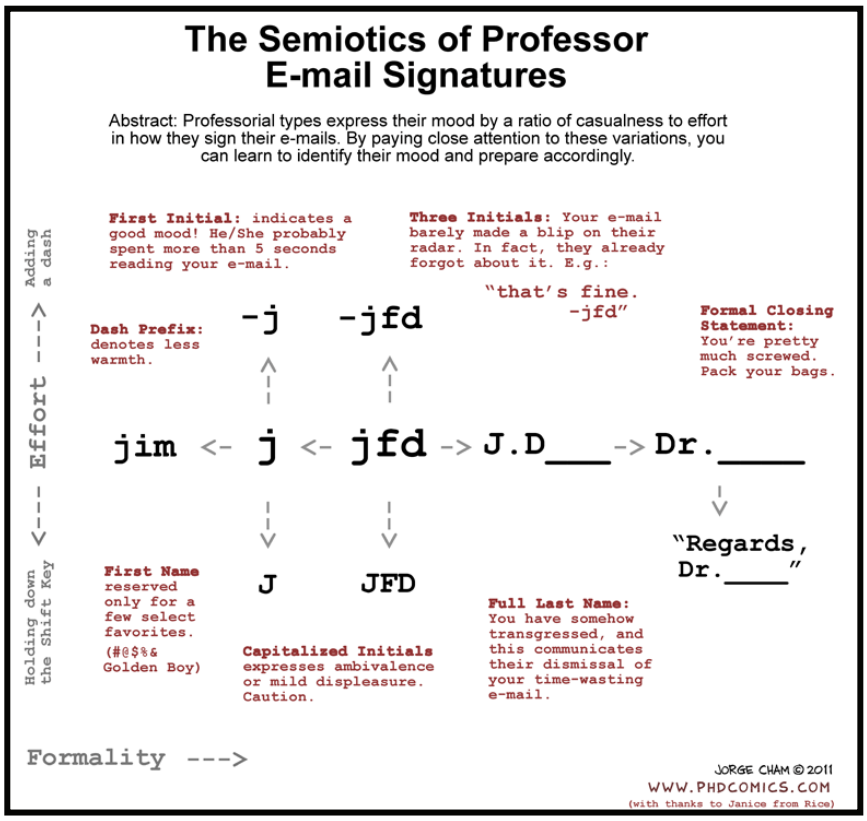


Another method for maintaining the narrative comes by the organization of the frames. In the Tezuka cartoon (left) you can see how the perspectives between David and Goliath is maintained by placing David on the left and Goliath on the right and how the frames are pointing at each other. In another Tezuka cartoon from the graphic novel series, "Black Jack," (right) you can see how the author conveys the multiple perspectives to the viewer of the different vantage points from which one could watch the surgery taking place.

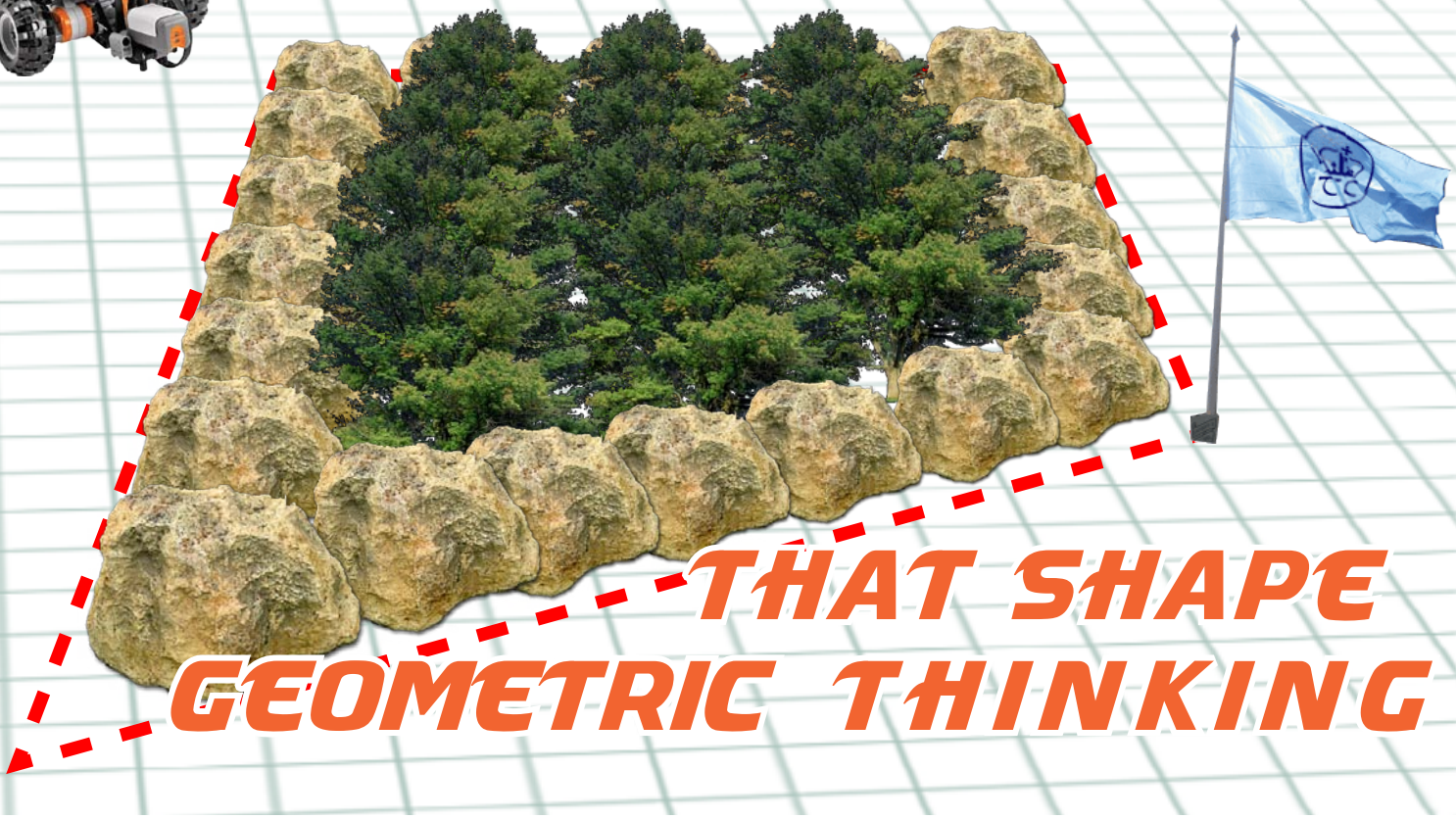
You can contrast that to this graphic from another story by Neil Gaiman about an aging film director who is dying (left). In the first frame, we see the director sitting in a chair reflecting about all the people that he has worked with over the years. In the next frame (right), we see images of faces that indicate who the director is looking at, which provides us insight into the directors thoughts and the memories.

In another illustration by Steinberg (left) we see that the mirror on the wall gives us an interesting juxtaposition of perspective. In this drawing, we are the voyeur looking into the window of an aparment. On the wall hangs the mirror that is reflecting the apartment building across the way where another voyeur is also looking into the apartment. Thus, the mirror becomes another window of perspective that allows us to voyeur the voyeur. Frequently, comics will provide you the ability to see both the whole and the parts at the same time.

Professor Tversky continues to explore these concepts in a number of classes here at Teachers College including *Visual Explanations* and *Spatial Thinking* as well as her continuing research with her students. Look for Parts IIB and III of this article, ***Segmenting & Connecting: From Event Perception to Comics*** in the next issue of HUDN! If you'd like to explore more, you can contact Professor BarbaraTversky at: btversky@stanford.edu.

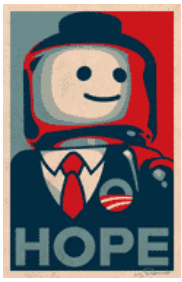


FINDING THE PATHS



THAT SHAPE GEOMETRIC THINKING

Take a look at the grants being offered for educational research by the National Science Foundation, the National Institute of Health, the Carnegie Foundation, the Gates Foundation and a host of others. What you will find is that there are millions of dollars up for grabs if your research addresses how learners develop their mathematical thinking. The United States continues to fall behind countries like Singapore and Sweden in math and science achievement. In response, President Obama announced the "Educate to Innovate Campaign." This campaign includes $260 million in support from corporations like Intel, Xerox, Kodak and Time Warner Cable to increase proficiency in math and science. Fortunately for Teachers College, Ph.D. candidate Jonathan Vitale is on our team.



Jon is a fifth year Ph.D. student in the Cognitive Studies program working under Professor John Black. Jon was born in Westchester, NY and admits that growing up he was "fairly terrible" at basedball and found LEGOS as a hobby. He notes that some of his projects were constructions from instructions while others were novel creations stemming from his imagination.

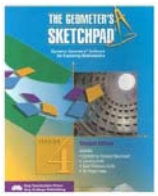
Reflecting on his early education, Jon recalls, "I don't know that I was interested or disinterested in school when I was younger… it was just something that you do. Before high school, I remember wanting a chemistry set at some point, but my parents were afraid that I was going to blow some sh*t up."

"In high school, bio was probably my best subject. By the time I got to college I wanted to be a chemistry major." As it turns out, Jon found his fit, majoring in a special dual-degree program at the University of Pennslyvania in Cognitive Science. "I was really jealous of my friends who were

in the Computer Science school and they were doing cool stuff like making computer games. I wanted to do that. So when I found this dual-degree offering in the registrar book, it was everything that I was interested in—the practicality of doing computer science combined with psychology."

By the time Jon emerged from his undergraduate studies the country was in a recession. The dot.com bubble had just burst and the marketplace was grim. Jon ultimately landed a job working for a non-profit called *Project SEED* that taught specialized math classes in the public schools. After working there for one solid school year, the company laid-off over half of the employees in his office. The state govenrent had taken over several schools, which negated a big contract that the company held with the city of Philadelphia. "After that, I wanted to get into the software and gaming industry, but with the tech sector restructuring, the outlook was dim." That's when Jon went to a job fair and discovered the New York Teaching Fellows Program.

Jon was already furthering his own education, enrolling in math classes at the local community college. It all began to come together. His application to the program was accepted and Jon packed his bags and headed to NYC. "[In the teaching fellows program], they allow you to pick your preference for the school district. I picked upper Manhattan. Then they assign you to a graduate school where you pursue your masters. I was assigned to City College."

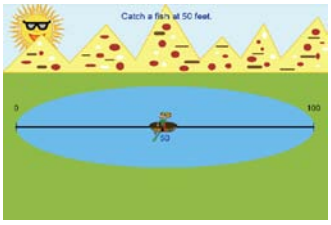


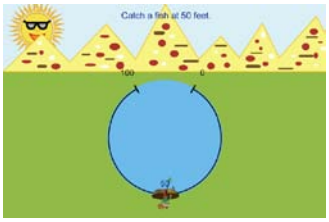
For the next two years, Jon focused on secondary math education. Working long days teaching at a high school in Washington Heights, he took classes at night and enrolled in intensive summer programs. Jon completed his masters and his thesis focused on children's usage of the software *Geometric Sketchpad* in the classroom.

"I always knew I wanted to be producing technology for learning and I guess that was a big impetus for me to eventually return to school. I looked around at a couple of other universities that had education and technology programs, NYU, Boston University and Connecticut. I saw the website for our departmental program before anything else and liked the way HUD's program focused on psychology, cognitive science and technology. When I met with John Black, he sold me on a couple of the projects that they were working on at the time, especially the REAL projects (software for simulating a complex system using conceptual knowledge and declarative knowledge and mind maps)."

"Early in the program, I took Jess Hammer's games class and really enjoyed it. Then at some point, I started working with a professor at Cornell Medical School in their neuroscience department on some projects focusing on mathematical cognition and development and that helped steer the focus of my work. Eventually, I encountered Robert Siegler's work (currently a visting HUD professor from Carnegie Mellon) on mathematical cognitive development along with a paper by Halberda, Mazzocco and Feigenson [*Individual differences in non-verbal number acuity correlate with maths achievement* (2008)] that appeared in the journal, *Nature*. Siegler's work on board games (*see* HUDN, Spring 2010) was a stepping stone that worked perfectly for what I wanted to do. He was using analogue board games and I wanted to take his work and apply it to the digital realm.

"My first project was a game in which users attacked monsters by aiming a canon. The idea was that they could learn about angles by aiming the canon properly to thwart the advances of the monster. From that study, I moved on to a project that more closely resembled a digital version of Siegler's board game number line work."

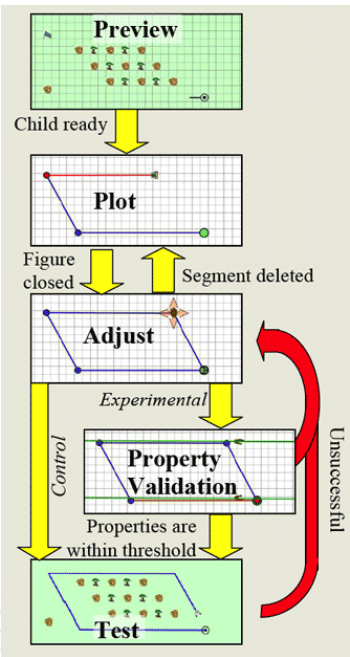




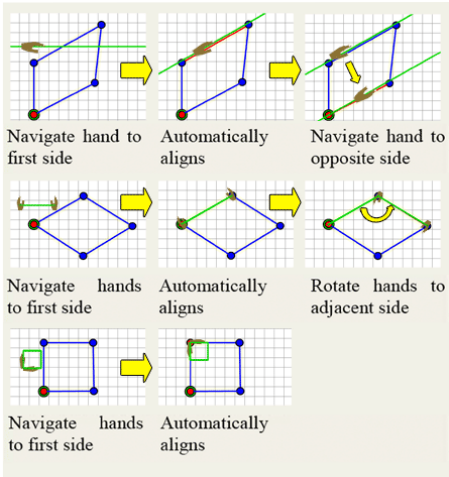
Jon's next project was a computer game designed to facilitate learning of the numberline. The context was that users were out fishing and students had to place the boat on the correct point of the number line in order to catch the fish. "Responses to the game was very positive. Though I am far from a good graphic designer, the kids seemed to appreciate many of the motivational goodies that were in the game." The kindergartners selected their different levels and on each level caught a different kind of fish. After they completed each level, they got to view their acquarium where their fish were swimming around–like a living trophy room." (P.S. No digital fish were harmed in the making of this game.) Experimental manipulations in the game compared linear number lines to circular number lines and found strong evidence for benefit of the linear display and mixed results for the inclusion of quartile landmarks along the numberline. Jon recently submitted this work as both his theoretical paper and his empirical data for his dissertation. Jon acknowledges that there is plenty of room for furture studies to address the how's and why's of childrens linear number line learning.

Amazingly, the prolificness of Jon's research doesn't stop there. In addition to his dissertation work, Jon has continued to explore other aspects of how kids learn mathematics. HIs latest project is exploring geometric thinking.

In this new game, students meet the challenge of safely navigating a virtual agent (a robot) around an obstacle course. Hazards around the obstacle course are arranged in geometric patterns and students must create shapes that allow the agent to collect rewards positioned at verticies of the shapes and return to their home position. Among the series of adventures, students help the robot avoid nuclear waste, save dolphins from oil spills, rescue miners from entrapments in caves and swoop snow angels from the clutches of evil snowmen.



The program encourages kids to use their bodies (hand gestures) to not only visualize but embody geometic properties of a shape (congruency of sides, angles and parallelism) and incorpoarte that knowledge into their solutions. Preliminary results show that this self-paced embodied curriculum is a better tool for learning than traditional methods that focus on comparing the numeric values of lengths and angles.

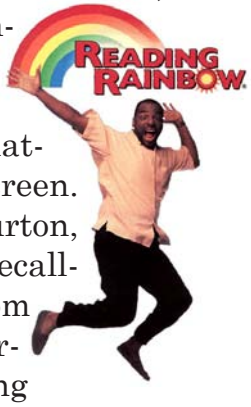


When I asked Jon if he had a take-home message for his fellow students, he paused for a moment and then offered up the following advice: "Figure out how to make our big ideas as simple as possible."

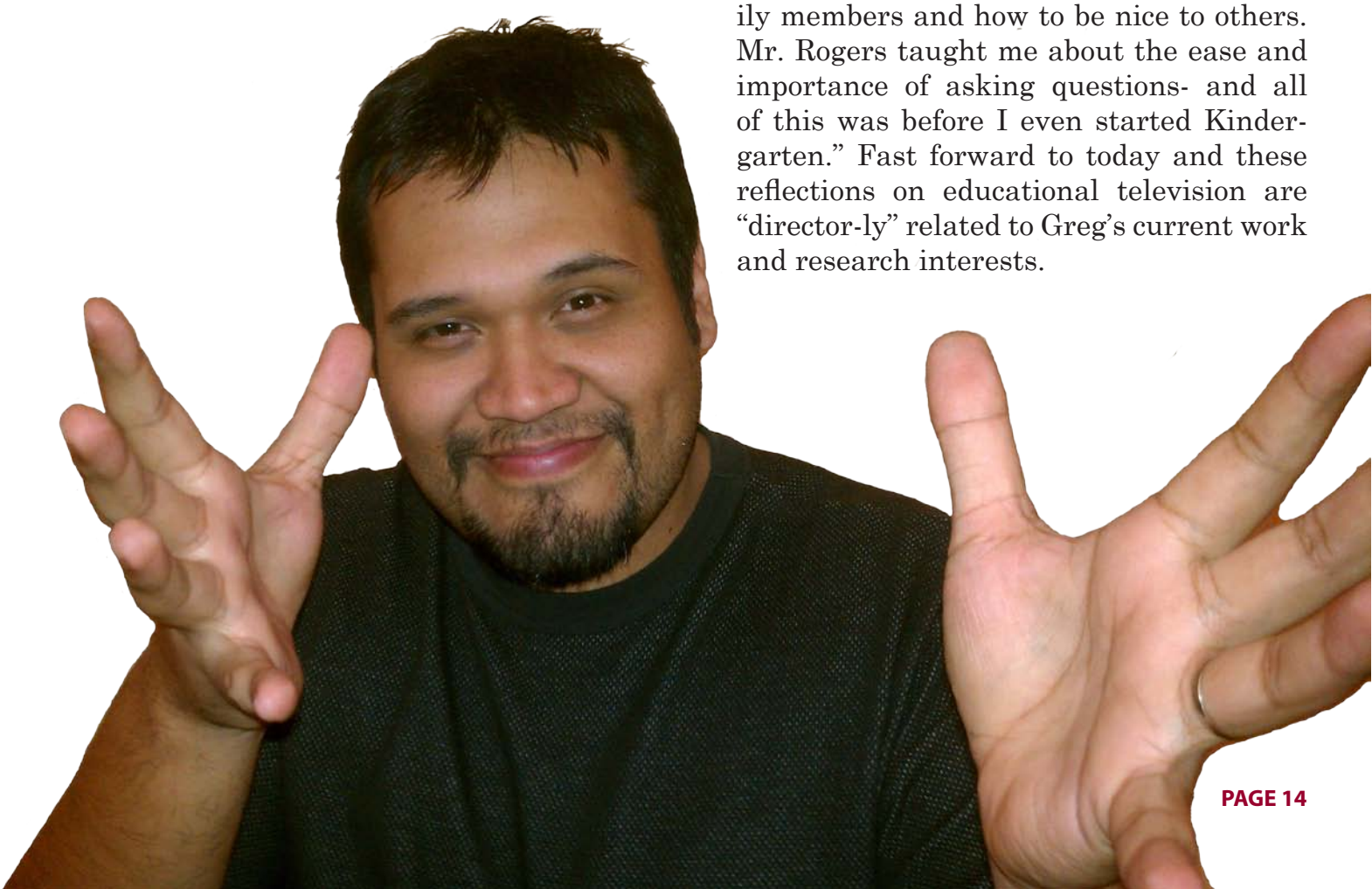
GREG's in the HALL, MAN

Greg Hallman with
Michael Swart

His name is Greg Hallman Jr. and he has watched many hours of television over the past 30 years; that means that when he was a little guy glued to the screen, new episodes of "Reading Rainbow" were airing on PBS.



"I was captivated by the stories and related to the children on the screen. I felt that host, Lavar Burton, was truly my friend." Recalling the pleasure he felt from watching television after-school or before the morning bell in his kindergarten classroom, a smiling Greg is convinced that he directly benefited from educational television programming in many ways. "*Sesame Street* taught me how to talk to adults that weren't family members and how to be nice to others. Mr. Rogers taught me about the ease and importance of asking questions- and all of this was before I even started Kindergarten." Fast forward to today and these reflections on educational television are "director-ly" related to Greg's current work and research interests.



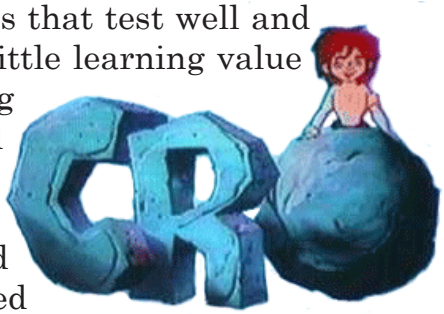
increasing access, persistence and preparation of America's future leaders for the 21st

The Gates Millennium Scholars Program

Funded by a Grant from the Bill and Melinda Gates Foundation

Greg, an inaugural-year Gates Millenium scholar, first arrived to Teachers College in 2003 as a Master's student in the Anthropology and Education program. Fresh from his native Oklahoma and a recent graduate of Oklahoma University, New York City presented many opportunities for Greg. With two little brothers, he is the first in his family to go to graduate school.

It didn't take long before he found himself taking his first bite of the Big Apple. This bite included an internship with Sesame Workshop – the creators of *Sesame Street*. "Finding out about that internship was an epiphany. I realized that I want to create educational media for the rest of my life." Greg interned for David Cohen, a director of research at Sesame and a recent speaker in the Technology & Human Development Presentation Series here at TC. Together, they observed pre-school kids watching *Sesame Street* and then asked the children questions about what they saw. Greg recalls, "I learned that pre-school students lose attention during slow songs and that often successful shows that test well and produce effective learning can get cancelled while others with little learning value continue to run on-air." The effective show Greg is mentioning was called "Cro". It was well-tested, got great ratings, and had NSF support but for some reason it didn't last.



"Working at Sesame was also great because it was proof that a non-profit with 500 employees could thrive in doing something pro-social. I loved being a part of it and seeing how so many people could work together."

sesameworkshop.

The nonprofit educational organization behind Sesame Street and so much more.

After taking a course on TV and the Development of Youth, Greg switched to the Communication and Education Master's degree in the Communication, Computing, and Technology in Education program. Soon after, Greg received inspiration from educational television superstars and TC graduates Angela Santomero and Alice Wilder, the former being the creator of the hit educational programs *Blue Clues* and *SuperWhy?* (see HUDN, Spring 2010 issue). "For my masters thesis project, I explored the possibility of interactive television. At the time, it was still a very real possibility even though it has fallen by the wayside in the meantime.

Under the guidances of Shawna M. Bu Shell and Prof. Charles Kinzer, I designed an interactive television show that had an accompanying website called *My friend Chassi* (like from a car). The character was inspired by a student I had worked with named Chassimira, a 4th grade Latina girl who hated Barbies but

Ken-Ken!

In each thick-line "block", the target number in the top left-hand corner is calculated from the digits in all the cells in the "block", using addition (+), subtraction (-), or multiplication (x) as indicated by the symbol by the target number. All the digits 1 to 4 must appear in every row and column.

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loved cars. In the show, Chassi's dad was a mechanic and her sister was an engineer. The show sought to explore the emotional route of a tom-girl who wanted good grades, no gossip, and excelled in math and science. Not long after, the show *iCarly* came out which was very similar, except instead of mechanics, it was technology." After finishing that project, Greg's cites his mentor's leadership, combined with the guidance and expertise of Prof. John Black, that lead him to his current doctoral studies in the Cognitive Studies program.

Now a fifth year doctoral student in the Cognitive Studies program, Greg has been involved with many projects since joining Prof. Black's lab. Greg's interests principally revolve around embodied cognition and the use of technology as a tool for education. Greg already does research with fellow Ph.D. candidate Seokmin Kang on using different types of gestures to convey information and ways that teachers can utilize this information to more effectively delivery material to their students.

"One of the things that interests me about cognitive studies is that no matter how the world changes, or technology changes, the human brain does not shift as quickly. You could make the argument that we process much more information much faster now, but how we develop has remained relatively constant. Whether we have a classroom that is all in-person-lecture, on the computer, or reading a book, we still gesture when we communicate to one another." Greg wants to look at how educators can create simulations with which the learners' gestures can activate the delivery of content.

"Barsalou (2008) would argue that cognition is linked to bodily states, the environment, perception and perceptual simulations. I want to marry perceptual simulations to the classroom environment using technology like the new Microsoft Kinect® to teach physics so that they not only remember the material, but the understand it, and how they, as physical beings in the universe, also embody it!!"

Greg recounts recent inspiration from a TED talk by Malcom Gladwell on spaghetti. "In education, we think about what motivates kids. Twilight? Angry Birds? Star Wars? In my case, I want to know what is going to motivate a child now in 2011; and is it the same as what motivated kids in 1911; and will it be the same in 2111? It is hard to find these unknowns—the public is fickle. Do people like things because of their social influences? How do we really know what they want? Consumer trends are interesting because they indicate willingness for someone to divvy out money for something. In education, we want to find what motivates them in to divvy their attention towards learning."

Recently, Greg took some time away from TC to pursue one of his other talents, that of television director. Last year, Greg returned to Oklahoma where he was hired to produce and direct a short TV novella Public Service project. The 30-minute video contained a fictional story/drama of a family in Oklahoma City with a daughter in 7th grade. Viewers followed this family's story while a host guided them through the beginning, middle, and end of the story, offering alternative solutions for the family's problem. After the story's happy ending, the host offered viewers synopses and points for consideration.

"Under the direction of Gloria Torres, the middle school's administrator, the project was designed to communicate the importance of parental involvement in schools via a 30-minute Spanish language video presented on DVD. The DVD was distributed to middle school parents (specifically Spanish-speaking parents) with the goal of inspiring an increase in parental involvement and parent-teacher conference attendance. After making three of these videos I learned that the 'soap opera' style narratives really did an effective job of communicating the message."

In 2011, Greg is planning to incorporate active embodiment, direct manipulation, narratives, and gestures into a physical science curriculum by way of the new Microsoft Kinect® sensor. "Thought and knowledge emerge from dynamic interactions between body and the physical world, which also include perceptual simulations like the one I want to make using the Kinect." The study will also include an attempt to improve memory and transfer for middle school students. "As the one of the few Latino males in the Human Development Department, I not only hope to make Prof. Black and my lab-mates proud of my performance, but also serve as an example for others. I want to work hard, design solid experiments, make relevant contributions to the literature and, in the words Ernest Rothkopf, 'discover truth'."

Spots in the neighborHUD

RESTAUSPOT
Chez Lucienne

308 Lenox Ave (@ 125th St.)
New York, NY 10027

MUSPOTEUM
The Studio Museum

144 West 125th Street
(btwn F.D. Blvd & A.C.P Blvd.)
New York, New York 10011

GROCERY SPOTORE
Trader Joes

2075 Broadway (@ 72nd St.)
New York, NY 10023

SPOTUSHI
IZUMI SUSHI

139 W. 28th Street
(@ 7th Ave.)
New York, NY 10001

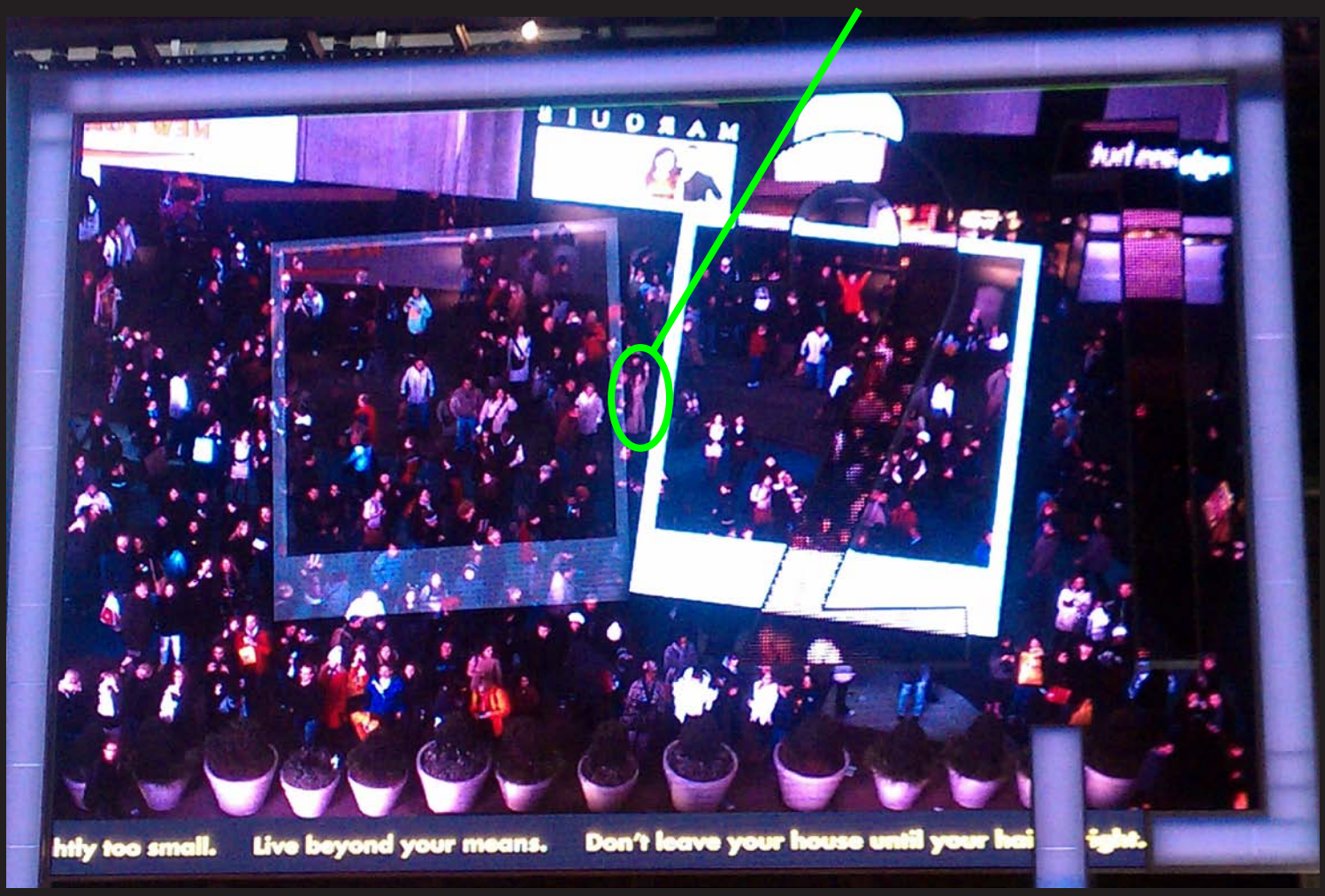
CREPE'SPOT
Crepes on Columbus

990 Columbus Ave
(btwn 108th St & 109th St)
New York, NY 10025

SPOTCOLATE
Lily O'Briens Chocolate Cafe

36 West 40th Street
(Off Bryant Park @ 6th Ave.)
New York, NY 10018

WARNING: This is a little errie. This past November, my parents came to visit me for Turkey Day. After the parade, we walked through Time Square where there is a big electronic display that takes pictures of the crowds below. There is my mom waving in the middle...



BUT... While people are looking for themselves in the display, look at the messages scrolling across the bottom!

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5	2	3	1	8	7	6	4	9
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