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ABSTRACT

This document introduces "Blue's Clues", a television science program and its development process. Blue's Clues is a series on Nickelodeon and currently telecasts five days a week. Childhood development theory states that young children learn skills through repetition; therefore, the same episode is presented on five consecutive days. This study explains the structure, preschoolers involvement in changes in the episode, and evaluates the script "Bugs", episode #411. A model of the construction of "Bugs" and other episodes of "Blue's Clues" is provided. (Contains 20 references.) (YDS)

Science on Television: Case Study of the Development of "Bugs" on
Blue's Clues.

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Blue's Clues

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Blue's Clues is a preschool television series that premiered on Nickelodeon in 1996. It is currently viewed nationally by approximately 10 million viewers per week. Its mission is to empower, challenge, and build the self-esteem of preschoolers, all while making them laugh. Specifically, the goals of the program are to empower preschoolers to learn through active participation in activities that are grounded in their everyday lives, to redefine the approach to problem-solving for preschoolers in an engaging environment, to encourage preschoolers and those who work with them to apply the thinking skills and activities presented on *Blue's Clues* to contexts outside the television world, and to model prosocial messages. An important dimension of the *Blue's Clues* philosophy is the central role played by an in-house research department. The research department uses its own members, outside consultants, and preschoolers themselves in the evaluation and development of each episode (Wilder & Santomero, 1997).

Alice Wilder, Alison Sherman, and Karen Leavitt represent the research department at *Blue's Clues*. Alice is the head of the research department and was a member of the original team that developed *Blue's Clues* after the pilot was created. Koshi Dhingra became involved with the research department of *Blue's Clues* in Fall, 1999 as one of the consultants who provides feedback on science-related scripts. The first such script that Koshi read was "Bugs," an episode which will air on Nickelodeon in 2001. In the approximately two years in which "Bugs" was going through various phases of development, all the departments including scripting, research, production, storyboard, art, design, animation, edit, and music worked on different aspects of the episode.

In what follows, we describe television science, a perspective on the significance of the messages about science and scientists that are mediated by television. Our analysis draws upon the ideas raised by philosophers of science, television practitioners, the curriculum guide and philosophy of *Blue's Clues*, and critical science educators. We then use these perspectives to look at the development of "Bugs" as a case study of the thinking and practice that shapes a science-focused episode of *Blue's Clues*. We also present a more global model for the creative collaboration that goes into making a program that is both educational and entertaining.

Television Science

Television programming is potentially a powerful learning tool owing to a few properties. First, since complex cognitive tasks are most efficiently achieved by incorporating emotional valence (Anderson, 1997), and since television is best at telling stories through pictures (Apsell, 1992), the level of episodic learning that can occur through viewing programs is potentially high. Second, a central claim of cognitive flexibility theory is that there is a need to revisit the same material at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives in order for mastery of complexity and for cognitive transfer to be possible (Spiro et al., 1991). Television programs, with their associated film techniques, have the capacity to portray scenes from such multiple perspectives. Third, television is a highly accessible medium for most American children and represents a powerful cultural artifact. Brown and Campione (1994) posit that Vygotsky's zone of proximal development includes cultural artifacts such as books and film since the zone defines the distance between current levels of comprehension and levels that can be accomplished in collaboration with other people or powerful artifacts. Such artifacts function as mediational means, just as talk does, resulting in the appropriation of words and concepts. Television, therefore, is a powerful educational agent.

The Nature of Science and the Nature of Television Science

Postmodern philosophers of science and current reform initiatives in science education have placed society and culture at the heart of science, and therefore science education (Kuhn, 1970; Longino, 1990; Rorty, 1989; American Association for the Advancement of Science, 1993; National Research Council, 1996). Science is a social activity that is shaped by social values and aims and cultural practices. Further, constructivist theories of learning science point to the importance of personal relevance and prior conceptions if students are to construct their own understandings (Osborne & Freyberg, 1985; Bodner, 1986; among others).

Depiction of a science that is merely a collection of facts or "final form science" (Duschl, 1990, p 68), is epistemologically flat and does not lead to understanding by viewers. What is missing in most television programs that present science is focus on the contexts

within which knowledge claims have been made and focus on the process of solving problems. The result is a positivist view of science, in which singular truths prevail and the emphasis is on what we know (the facts) rather than on how we know it and why we think we know it, as well as a decontextualized view of science, in which science tends not to be proceeding within everyday contexts. The current preponderance of positivist ideas about science on television news and documentaries may result in reinforcement of viewers' notions about the segregation of science from everyday activities (Dhingra, 1999). Science consequently takes on an authoritarian dimension resulting in a lack of appreciation of the tentative and context-dependent nature of knowledge claims. The student-viewer is thus distanced from the human aspects of the scientific endeavor and is untrained in evaluating knowledge claims in light of evidence (Duschl, 1990).

In order to demystify science to children, it needs to be made clear that it is an inseparable part of everyday life. To this end, television's potential knack of providing engrossing storytelling structures with vivid images can be harnessed. Science can be shown to be embedded in everyday life. Science practitioners can be presented as coming from all walks of life and involving children of diverse backgrounds. A variety of contexts can be presented as the places in which science-related thinking is done. *Blue's Clues* is one such program because the goals of the series are in keeping with the goals of science education and what science is.

***Blue's Clues* and Learning**

The *Blue's Clues* philosophy, as articulated in its curriculum guide, incorporates the framework of situated cognition, which posits that knowledge is situated, being in part a product of the activity, context, and culture in which it is developed and used. Situated learning emphasizes the idea that much of what is learned occurs within the context of a child's everyday life (Anderson, Reder, and Simon, 1996; Brown, Collins, and Duguid, 1989). Implications of this on television-mediated learning include the strengths of the storied environments of television programs in providing the viewer/learner with authentic learning opportunities. Some of the strategies used by the creators of the program include the framing of everyday problem-solving situations in the context of engaging stories, a multi-layered approach to learning and playing in which an ascending level of difficulty within each

of the tasks, games, and activities is maintained, and the direct involvement of preschoolers by having Steve talk to the viewer and ask for their help.

Blue's Clues is said to have changed "the way preschool children watch television" (Nick Jr.'s *Blue's Clues* top dog, 1997, p. 1) by inviting viewers to become collaborative, active problem solvers with the program's lead characters, Steve and Blue. A two-year, longitudinal study of the effects of *Blue's Clues* found that regular viewing contributed substantially to preschoolers' visual attention to the program, their perceptions of being able to help Steve solve problems, their information acquisition, and their problem-solving abilities and flexible-thinking skills (Bryant et. al., 1999). *Blue's Clues* is telecast five days a week at 9:30am and 12:30pm (EST). The same episode is presented on five consecutive days - an unusual telecast strategy that is based upon child development theory and practice that states that children, especially the youngest children, learn and master skills through repetition. Findings from a study of the effects of this telecast strategy indicate that repeated experience with an episode bolstered children's participation with both *Blue's Clues* as well as with a different program that the children had never seen before (Anderson et. al., 2000; Crawley et. al., 1999).

Based on the power of television as an educational agent, the perspectives on the nature of science as discussed above, and the goals of *Blue's Clues*, we ask the following questions: How did the development of "Bugs" proceed from story conception onward? What nature of science is manifested on "Bugs" as program production and development on *Blue's Clues*, grounded in situated cognition theory and the program goals of viewer empowerment and engagement, proceeds?

The Development Process on *Blue's Clues* (Alice's Perspective)

The initial script for "Bugs" was written by an external writer. The script topic was selected by scripting and research because the theme seemed appropriate for the target preschooler viewers and had not been attempted previously on the program.

The integration of research and writing is unique at *Blue's Clues*. It involves an extremely collaborative process that includes a respect for what research knows about its audience: child development, how preschoolers watch TV, learning theory, and an accrued knowledge of how preschoolers from ages two to six work with the content of *Blue's Clues*.

At the same time, the writers come with their creative vision for the show as a whole as well as how each individual script fits that vision. The writers each have a vision of their own: they have their own ideas about what they want the script to communicate, who preschoolers are, and how they think preschoolers will react to a script. It is only through the combination of these three creative processes that a program can be truly educational, entertaining and a huge success among its audience.

Research's role in this process is to represent the preschool viewer. This is done both before and after bringing the script-specific information into preschoolers themselves. Preschoolers learn through everything they do. When a writer comes up with an idea, he/she shares it with the research department. We then have a dialogue about whether this topic and approach to the topic would be something within the realm of a preschool world or not and then develop the content from there. In the case of "Bugs," the head writer came to me and presented the topic: bugs. He said, "What do you think of that?" I said, "Preschoolers love bugs. They are fascinated by them and often squeal with delight or are freaked out when presented with bugs." I said, as I always say, "What does the writer want to say about bugs?" And the development process begins.

Often the first step is this conversation that I, as the director of research and development and "surrogate" preschooler, have with a writer who comes in with an idea that has not been fleshed out. We talk about both the subject matter and preschoolers; particularly, what's important about that topic to preschoolers? If I don't know the answers, we call someone who has an expertise in the subject matter. If we do talk to an outside consultant, generally the writer and I will sit in on that call together. In some cases, the writer and I will go to a class and watch preschoolers do what we are setting out to write about.

While consultants are experts in the subject matter and the processes involved in getting across various concepts, we at *Blue's Clues* are the experts in the show's goals and philosophy, and how those concepts will translate in the medium of television rather than in a classroom, museum, or theoretically. Ultimately, however, our true experts are the preschoolers themselves, who will evaluate the script from their perspective.

The next step is for the writer to take all of this information, combine it with his/her knowledge of the show and its philosophy and goals, and write a treatment. The

treatment is a detailed outline of the script. It includes goals for the episode as a whole as well as for each game.

The Treatment Meeting

This meeting can best be described as an organized creative brainstorm. The writer has already outlined what the episode will look and feel like. The goal of this meeting is to give the writer all the information that he/she will need to make this script into a "workable" draft one. This meeting varies in the amount of feedback that is given. A concept can be completely revised, games can be changed, and storyline can be enhanced or changed. We often ask questions such as: Is this concept concrete enough for preschoolers to understand and be excited about from the moment Steve opens the door? Is the storyline enhancing the goals of the script?

Who is in this meeting? Myself and the writing department. First, the writer presents his/her goals for the episode and may start by walking us through the outline. For example, in "Bugs" the writer started out with a throughline that involved experiencing a "jungle" feel in our backyard. While this is very creative and exciting, it directly negates the writer's (and the show's) goal of getting preschoolers to take a closer look at the world around them. In the U.S., I wouldn't imagine that many preschoolers have access to a jungle where they can explore animal sounds. The conversation changed to an expedition in which Steve, Blue, and the other characters explore the backyard for bugs that preschoolers may actually find in their world. In this way, the episode became about observation and celebrating the ordinary events in a preschooler's life.

In another example, the writer had come up with a wonderful idea to "skidoo" to an anthill and learn about ants. Now that's something that preschoolers can't actually do, but might want to do—this makes for a perfect skidoo world. But what did the writer want preschoolers to learn about ants? He wanted to parallel the ant world with the human world. What are the benefits of that? Why is that important? Is there a way to show that without making the game focus on it, and learn specifics about ants? Research with preschoolers would reveal what preschoolers already knew about ants and how to make this game work using their knowledge and our goal to teach them more.

"Name that Bug" was the idea that the writer suggested for the first game. Ordinarily, this would be a very successful, clear game idea. However, what we always run into with science topics is that for a viewer to answer a question posed to them such as naming a bug, it requires prior factual knowledge of these bugs. Descriptions of each bug would only help if children already knew the name of the bug. This poses a problem for *Blue's Clues* because we want preschoolers to learn through exploration and observation. Therefore, we brainstormed ways to still name the bugs, but also to empower preschoolers to answer questions posed to them which asked them to observe, label their observations, and then use these critical thinking skills to call out why a bug is behaving in a certain way.

After much creative brainstorming rooted in the mission and philosophy of *Blue's Clues*, the art of good storytelling, and the preschool point of view, this script idea eventually becomes a second draft. At the second draft stage, a consultant with an expertise in the subject matter being presented, and preschoolers themselves are integrated into the process for further development.

Preschoolers' Role in Shaping "Bugs"

In this section, we (Alison and Karen) describe specific examples of changes made to *Blue's Clues* episode #411 "Bugs," based on the feedback of approximately 50 preschoolers in a day care center setting. Preschoolers were interviewed in order for their understandings and questions to be heard by us. Three rounds of research with preschoolers at such a setting are done for each episode: the concept test, the video test, and content analysis. This last phase of research is not described in this paper, since we have not yet reached that phase with "Bugs."

THE CONCEPT TEST

In every episode Blue leaves her pawprint on three objects, which comprise the Clue Set. The original clue set was: Antennae + Wings + Colors = Butterfly. In research, preschoolers were not answering "butterfly," but instead were guessing "ladybug." After this stage of research, the clue set was changed to: Wings + Colors + Chrysalis = Butterfly.

This was done for the following reasons:

- *Blue's Clues* likes to teach an unfamiliar word and concept whenever this can be done in a visual and concrete context.
- A chrysalis is more specific to a butterfly than antennae, so this clue would better narrow the clue answer down to butterfly.
- This would also enable us to incorporate all three clues more strongly into the end scene of the episode when the butterfly emerges from the chrysalis.
- Feedback from science consultants indicated that a chrysalis would be a nice scientific concept to incorporate more extensively into the episode.

Game 1, Backyard Bugs Game

The goal of this game is for preschoolers to identify the behaviors of three different bugs (a grasshopper, a mole cricket, and a stick bug), and to think about the "why's" behind these behaviors. An additional goal is to inspire preschoolers to observe other insects and animals at home and think about the reasons behind their behaviors. Originally, each layer of this game consisted of four tasks:

- Locate the bug in the scene.
- Label the type of bug (i.e., grasshopper).
- Label what the bug is doing (i.e., hopping).
- Verbalize possible reasons for *why* the bug is doing what it is (i.e., looking for food).

Locate the bug in the scene:

In research, preschoolers (especially the younger children, for whom the other questions were quite challenging) enjoyed finding the bugs in each scene. Therefore, we decided to preserve this interaction in each layer, even though it was not the primary goal of the game.

Label the type of bug:

We decided *not* to have preschoolers label the type of bug, for two reasons. First, *Blue's Clues* prefers not to ask questions of our audience that are contingent upon prior

knowledge. Second, learning the names of the bugs was not the writer's primary objective. However, in each layer one of our characters does label the bug, so that preschoolers can learn the potentially new names in this way.

Label what the bug is doing:

Preschoolers were very interactive when asked to describe what the bugs were doing. This was one of the primary goals of the game so this interaction was maintained.

Verbalize possible reasons for why the bug is doing what it is doing:

For these "why" questions, research found that preschoolers were suggesting several potentially correct reasons for the bugs' behaviors. To account for this, the script as written had left an open-ended pause after these questions. However, Steve's dialogue following the pause only reinforced one correct answer ("Yeah, maybe it's scared.").

Based on our experiences at research, the dialogue was changed so that Steve and other characters mentioned at least two possible explanations for each bug's behavior ("Maybe it's scared"..."Pail: "Or maybe it's looking for food?!"). This way preschoolers would feel that their responses were being heard, and that they were correct. Another benefit of this type of interaction is to model the brainstorming process, an important skill to learn.

Game 2, Antoinette Skidoo Game

The goal of this game is to learn specific facts about ants and ant life. Specifically, we wanted to include facts that were fairly basic about ant life. Research tested six layers to this game:

- What kind of bug is Antoinette? (an ant)
- Why can she lift the crumb? (she's strong)
- What should she use to find her way home? (her antennae)
- Where is her home? (the ant hill)
- Which room is for food storage? (locate in picture)
- Where is her mother? (locate largest ant in picture)

After research, the story for this game was simplified so that the facts we wanted to teach were conveyed in a naturally progressive plot. The newer version of the game sets the story that Antoinette is a worker ant and it is her first day on the job. She needs to find food, using her antennae, and carry it to her mother, the queen ant. The questions and child interactions for this new version of the game were then altered slightly to correspond with this story narrative.

Based on preschoolers' responses and the episode goal of presenting basic yet less well-known facts about ants, research recommended that the layering of this game be as follows:

- Layer 1 - What is that ant using to find its food? (its antennae)
- Layer 2 - Why can Antoinette lift that heavy crumb? (She's strong)
- Layer 3 - What is Antoinette's mother called? (The Queen)

The other three facts originally tested (that Antoinette is an ant, that ants live in ant hills, and that they keep their food in a storage room), were re-incorporated into the narrative of the game, presented in dialogue and visuals by Steve and Antoinette. This way, the information was still being taught, but the information we wanted preschoolers to generate was able to focus on the facts we *most* desired them to learn.

Specific finding for the "strong" layer:

Our science consultant had recommended we clearly demonstrate how much weight ants can lift in relation to their body size. Research illustrations portrayed Antoinette as extremely big and in response to the question, "Why can Antoinette lift that heavy crumb?" Preschoolers were responding that it was because she was "big enough," not because she was strong.

Therefore, research recommended to the art and design departments that we ensure Antoinette's size was more proportional to the environment and the crumb she is lifting. In this way, her size would not be the reason why she was able to lift the crumb.

VIDEO RESEARCH

After Steve is filmed, backgrounds are mostly designed and animation is very rough. We used these rough animations to present to preschoolers for further feedback on the evolving episode. Preschoolers watch television differently than they play with researchers as part of the concept test. Therefore, this video test phase is designed to assess preschoolers' reactions to the content and visuals as it pertains to how it is presented on television.

Stick bug layer: What is it Doing?

When showing this rough animation to preschoolers, it was challenging for children to identify that the stick bug was "hiding." Animators had shown the bug crouching down on the branch and blending in to hide, and then standing up for "not hiding." This is a particularly challenging bug to animate hiding, because in reality they "do" nothing except blend into their environment and freeze.

Instead of saying the bug was hiding, preschoolers labeled the action as "sleeping," "lying down," or "doing push-ups." To make this hiding action more concrete and visual, researchers studied scientific descriptions of stick bug behavior and made recommendations to the animation department for the stick bug's hiding actions. It was decided that the stick bug would move around on the branch when it was "not hiding" and then freeze when it was "hiding."

Why is it Hiding?

Animators tried to depict the Stick Bug as scared by having it scrunch back up again as Steve leaned in to see it. However, the scene was fairly wide and we were not close enough to see the bug very well. Preschoolers had a hard time understanding that the stick bug was scared. After research, we suggested adding an animation insert of the stick bug so we could get much closer and see that it was scared. In this new scene, the stick bug looks to us, its eyes get wide, and then it shrinks away.

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The Nature of Science on "Bugs"

As a science consultant on the script "Bugs," I (Koshi) identified seven educational objectives as follows:

- Appreciation that insects are fun and interesting to observe
- Appreciation that observation can answer some questions about insects
- Demonstration of some of the diversity of insect life in the backyard in terms of appearance and a few interesting insect habits
- Identification of the basic physical characteristics of insects
- Description of an ant community
- Demonstration of metamorphosis from chrysalis to butterfly
- Description of how insects see

I also saw that there were seven mini-stories being narrated. These were the following: ladybug; grasshopper; stick bug; mole cricket; ant; butterfly; how bugs see (video letter). I liked the attempt made to show a wide range of different insect types and lifestyles as well as the demonstration that one does not have to travel far to do real science.

Recommendations that I made included details such as asking for further explanation of what a chrysalis was as well as suggesting that the episode guide the viewers in thinking about why bugs were important (by asking a question such as, "What if there were no bugs in my backyard?"). Overall, I found the script to be a very positive one in that it modeled a process-oriented and highly contextualized approach to learning science.

In an interview with Adam Peltzman, co-head writer of the scripting department, he stated, "We're certainly not a science show, but...we've written about a hundred episodes, so we try to cover all areas. We've done...at least ten or so episodes that have some kind of science focus. I think it's really just about the developmental level of preschoolers, and what interests them. For them, science is about discovering the world around them and just noticing how things work, either how things change and seeing it right in front of your eyes, or experimenting with them. It's just very experiential, and I think you lose kids when you start getting bogged down in the words. But I think...they can absorb so much of that

information if it is presented in the context of actually seeing it happen. It's not that facts aren't important...but it's just about how it's presented."

Adam sees science on *Blue's Clues* as being part and parcel of what preschoolers find interesting and it is in this capacity that scientific concepts or phenomena are the focus of "Bugs" and the other science-focused episodes that have been developed. Even though he does not classify the program as a science show, he does see *Blue's Clues* as a program that focuses on what preschoolers find to be interesting and relevant to their everyday lives. As such, science becomes a key player on some episodes. Adam sees authentic learning situations as being key to children's learning of scientific concepts. His emphasis, even though his own role is to select and develop scripts, is on the presentation of appropriate contexts and engaging activities as opposed to the presentation of facts using just words and explanations. His views are very much in keeping with situated cognition and the *Blue's Clues* philosophy.

The Nature of Interactivity on "Bugs"

I was interested in the ways in which the script allowed for a high level of interactivity. A variety of questions, accompanied by appropriate pauses allowing for viewer response, guide viewer interaction with the activities on the program. Most of these questions are initiated by Steve, although questions asked by children's character voices are also sometimes included. Further, Steve supports viewer ability to answer questions by suggesting what they need to do in order to arrive at the answer. He also encourages viewer participation by directly inviting them to participate in the activity. Multiple possibilities are accepted by Steve. He underscores the open-ended nature of his questions and the lack of singular, right answers and even adds, "It could be anything really." Table 1 below lists questions and other techniques which work together to construct an accessible, open-ended, inquiry-based science on "Bugs."

Table 1: Sample excerpts from the "Bugs" script highlighting strategies used to invite children viewers to participate in the activity, questions asked to promote observation and higher-level thinking, strategies proposed to help problem-solve, as well as children's responses used.

Note: The following are comments or questions made by Steve, unless otherwise noted.

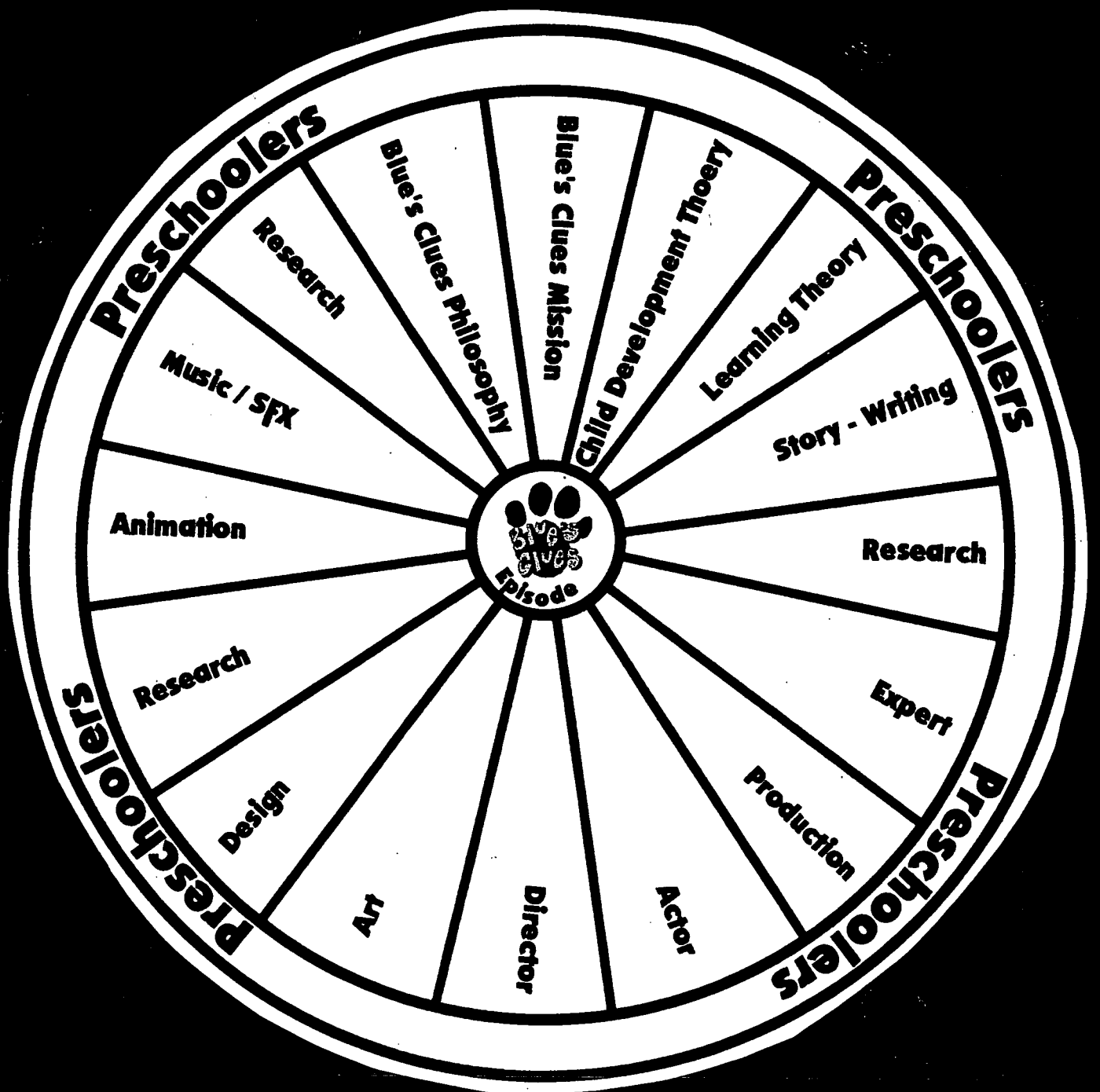
Invitation to Participate	Questions directed to the Viewer	Suggestions to the viewer of Problem-Solving Strategies	Preschooler's Voice-Over Responses to Questions
Hi! We're going on a bug watching expedition. Want to come?	Why do you think the grasshopper hops?	I wonder why (the mole cricket) digs these tunnels. Let's take a closer look and figure it out. Bugwatchers-watch!	Maybe it's looking for food. (Periwinkle) Or maybe that's how it gets around.
Let's play Blue's Clues to discover what Blue's favorite bug is.	What's [the mole cricket] doing in the dirt?	Hey, these wings are our first clue! You know what we need, our handy dandy... (notebook! (Kids)).	It's digging! (Kids) It's digging tunnels, just like a regular mole!
I think I'm going to need your help to figure out what Blue's favorite bug is. Will you help me? You will? Excellent!	Why do you think the mole cricket digs these tunnels?	Let's see, what's that other ant using to find its food? (enough time for the kids to notice the antenna movement)	Maybe it's making its home. It could live in that tunnel. (Shovel) Yeah! Or maybe it's resting.
Do you want to help Antoinette the worker ant? You do? Great!	What do you think the stick bug is doing?	We're ready to sit in our...(thinking chair! (Kids))	Hiding! (Kids)
	But why is it hiding? (Pail)		Maybe it's scared. Or maybe it's looking for food. (Pail)
	What is that other ant using to find its food?		Its antennae! (Kids)
	What do you think Blue's favorite bug is, with wings, colors, and a chrysalis?		A butterfly! (Kids)

A Model of the Construction of "Bugs" (and other episodes) on *Blue's Clues*

The following is a model to demonstrate the unique collaboration of the entire *Blue's Clues* team in creating and developing every episode of *Blue's Clues*. At the center of the wheel is each and every *Blue's Clues* episode. As this model demonstrates, preschoolers are both the starting point in which all episodes are created and also the end point to which all information is transmitted back out. The three phases of research referred to in the model are concept test, video research, and content analysis. Preschooler participants in these phases provide valuable feedback on the different stages of program development to the *Blue's Clues* production team. Each spoke of the wheel describes all of the thinking and creative vision that each episode is built upon. It is true that as each episode is developed and each spoke becomes a part of the greater whole, so too does the vision of each script become enhanced.

The greatest strengths of the development of "Bugs," and all episodes on *Blue's Clues*, are twofold; first, the high levels of collaboration between all departments and the clearly-defined strategies followed in order to effectively harness preschooler thinking in the development process. Second is the clearly-defined philosophy, mission, and structure of *Blue's Clues* (consistently referred to by all members of all departments), which are grounded in situated cognition, child development theories, and theories of how children watch television.

A Model of the Construction of "Bugs" (and other episodes) on *Blue's Clues*



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