Telling the Science Story:
An Exploration of Frame Effects on Public Understanding and Support For Early Child Development

A FrameWorks Research Report

prepared for the Frameworks Institute

by

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There is little doubt that the well-being of children is of central importance to any society. The old saw that "our children are our future" may be trite, but points to the incontrovertible fact that society's outlook depends upon securing the interests of today's children. How to secure this future, however, has been a matter of considerable debate.

While advances in neurobiology over the last quarter of a century have clarified important relationships between genetics and early childhood experiences, they also call into question the relationship of science to the public good. That is, how should the scientific community explain these important new discoveries to the public as a means to advance quality of life in the society? Of immediate concern to this report is the notion that scientists should communicate with the public. They should do so, it is argued, for several reasons (Weigold, 2001). The first is that it contributes to the effective workings of a democratic society. A second is that scientific literacy, in and of itself, is a desirable outcome. A third reason, and one more germane to our focus, is that the applications of science can profoundly change people's lives. As such, how the public understands (or misunderstands) science has a profound effect on its support for, or resistance to, a particular set of policies and programs. The ways by which the public understands the science of early childhood development, by this account, can influence the direction of "competing demands on limited resources" (Center on the Developing Child, 2007a:1).

The FrameWorks Institute, in collaboration with the National Scientific Council on the Developing Child; the National Forum on Early Childhood Program Evaluation; and the Center on the Developing Child at Harvard University, has been engaged in a multi-year, multi-discipline study of how communications about early child development (ECD) influences public attitudes and policy preferences (see Bales, 2008). This report is an experimental examination of the impact of exposure to central elements of the basic scientific story about ECD - as developed by the collaborators - on people's support for programs and policies associated with the developmental perspective. By core story, we mean an enumeration of the fundamental scientific principles that one must understand in order to achieve a rough appreciation for the process of early child development.

Borrowing from the cognitive and social sciences, we utilize the notion of "frames" to conceptualize how people use information about the core science of ECD to make judgments. In other words, we test for framing effects produced by exposure to the core scientific story of early child development. We also consider the role of moderating factors – such as prior beliefs about the importance of children's issues and other individual differences – on framing effects. Finally, we take up the question of how much information about the science is necessary to convey. Specifically, we explore whether adding more concrete information – in the form of simplifying models – matters for heightened support of policies and programs. And, does it matter if this additional new information is confirmatory or conflicting to the original communications? In all, our basic research question is:

Does exposure to the core scientific story of early child development have a measurable impact on support for programs and policies advocated by child development experts?

The report takes the following form. We begin with a discussion of the concept of framing. We then lay out the core scientific story of early child development as articulated by the FrameWorks Institute and its scientific collaborators. Next we describe the experimental design and measurement issues. The results from the experiments are displayed, and the final section summarizes the report and discusses its implications for communicating the science of early child development.

Framing Social Issues

The concept of "frames" is very much in vogue these days. Pundits, journalists, public relations experts, advocates, and scholars routinely use "frame" to describe how their worlds are understood. The problem, as many observers have pointed out, is that there is tremendous ambiguity, overlap, and general confusion about the nature and impact of frames. Cappella and Jamieson (1997, p. 39) note that framing ''has been used in different ways in several different disciplines to mean different things with different outcomes" (see Chong and Druckman, 2007 for a good review of the literature on framing theory). While it is beyond the scope of this report to recap this rather vast literature, it is helpful to present some widely used definitions of frames and framing (see also, Kinder, 2007; Reese et al., 2001):

> *"Frames are principles of selection, emphasis and presentation composed of little tacit theories about what exists, what happens, and what matters."*
> *(*Gitlin 1980: 6)

> *"[f]rames activate knowledge, stimulate 'stocks of cultural morals and values, and create contexts."*
> (Cappella and Jamieson 1997: 47)

> *"[t]o frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation."*
> *(*Entman 1993: 52)

In short, frames are devices that people use to organize information in order to make meaning out of the world around them.

Our interest in frames is built around the idea that people's attitudes and opinions can be affected by exposure to a frame or elements thereof (Chong and Druckman 2007; Iyengar 1991). The conventional belief is that framing effects on public opinion are the by-product of a psychological process known as accessibility (Entman, 1993; Kinder and

Sanders, 1996). That is, contextual cues in frame-based information are thought to activate those cognitive structures that stay "on top of the mental bin" (Domke, Shah, and Wackman, 1998), thus becoming more accessible in memory (at least in the short term). In turn, these cognitive structures form the basis for subsequent judgments (Wyer and Srull, 1989).[i] This temporary activation is typically thought of as 'priming' (Iyengar and Kinder, 1987). Put differently, the application of a frame has the capacity to promote a particular definition, causal responsibility, and solution to a problem or issue (Shah et al., 2002).

Past literature has posited that frame effects can be measured in several ways. In some instances, researchers have measured the impact of a particular frame on judgments by comparing its relative influence to another, alternative frame (Druckman, 2001). Take, for example, an experiment that exposes people to two frames about health insurance. The first calls attention to the role of the individual as a consumer of health insurance. In this frame, the responsibility for securing appropriate care is implied to be a function of an individual's knowledge, motivation and capacity – "buyer beware" is the operative caution. The second frame, to the contrary, makes salient the notion that effective health insurance policy is a matter of devising a system that minimizes risk to individuals by maximizing the number of people in the system. A frame effect is said to occur if those exposed to the systemic frame are more supportive of universal health coverage than those exposed to the individual responsibility frame.

The problem inherent in this measurement technique, however, is that it is all relational. That is, any given frame effect depends upon competition from another frame. As Chong and Druckman (2007) point out, two frames might influence opinion in a similar direction but there may not be a sufficient difference between them to count as a framing effect. A more useful measure of frame effects is to consider the impact of a frame against a control condition in which respondents are not exposed to an influential communication at all. A framing effect is said to occur if the attitudes and preferences of those exposed to the frame differ significantly from those in the control condition. The assumption is that the information receives more weight because of its relative accessibility and thus its ready application.

The literature suggests that framing effects can be attenuated by several factors. In some cases, strong prior beliefs about the issue or object will trump activation by short-term contextual cues (Chong and Druckman, 2007; Iyengar, 1991). In other words, there is a distinction between the temporary activation of cognitive structures and the chronic accessibility of long-standing beliefs. For example, prior beliefs or predispositions have been found to shape people's evaluations of particular frames (Brewer and Goss, 2005; Zaller, 1992). In some cases frame effects have been attenuated when incoming information is inconsistent with deeply held values-based beliefs (Brewer, 2001). Others have found framing effects to be moderated by political knowledge (Druckman and Nelson, 2003) and the credibility of the messenger (Druckman, 2001). The point is that frame effects are susceptible to moderating influences.

Framing effects may also depend on the extent to which the incoming communication is congruent or consistent with cognitive structures. From this perspective, information consistent with available schemas or mental models are more easily encoded and categorized than schema-inconsistent information (Smith, 1998). As Shen (2004: 128) observes, "[S]chema-consistent information is more likely to be encoded and more easily categorized than schema-inconsistent, which is more likely to be ignored and not encoded". In short, framing effects may depend on interactions with strong beliefs and/or the extent to which the information stream is symmetrical or asymmetrical.

Our account of framing, of course, leaves out several conceptions and approaches that are found in the cognitive and social science literatures. For instance, we are less interested in how and why the news media framing affects public opinion (see Clawson et al., 2003; de Vreese, 2005; Entman, 1989, 1993; Gilliam and Iyengar, 2000, 2006; Gilliam, Valentino, and Beckman, 2003; Iyengar and Kinder, 1987; Pfeffley and Hurwitz, 2002); how frames affect the evaluation of political candidates (Druckman, 2004; Iyengar, 1991; Kahn and Kenney, 2002); the role that values play in framing (Brewer and Gross, 2005; Chong, 1996; Gamson and Modigliani, 1987; Nelson et al., 1997); the relationship between framing and power (Entman, 2007) and social movements and framing (for a review of this literature see Benford and Snow, 2000). Nonetheless, the questions we raise, as well as the evidence we bring to bear, ultimately have consequences for a wide range of framing approaches.

Framing the Core Story of Early Child Development

Since 2001, the FrameWorks Institute has been conducting research on how the public thinks and talks about early childhood (see Bales, 2008). This body of work relies on a wide range of methods (e.g., intensive one-on-one interviews, focus groups, media content analyses, and public opinion surveys); and has examined a number of different populations (e.g., engaged citizens, parents and non-parents, business executives, legislators, and civic leaders).[ii] This investigation into the framing of early child development, then, spans time, space, method, and populations.

The fundamental finding of this work is abundantly clear: the public has a limited understanding of early child development. As Bales (2008) notes, "The current language that experts and advocates use to convey early child development holds little meaning for the laypublic, so people tend to fall back on their internalized frames." For example, the most available frame for people is the notion of the "black box." That is, either everything or nothing influences the development of children. They are either products of all things in their environment (a "sponge") or they are set on automatic pilot (a "ticking clock"), emerging sometime in late adolescence or early adulthood as self-actualized beings. Either way, this type of reasoning conceals the workings of the developmental process; a process that the neuroscience research has worked hard to document. Moreover, because people have little understanding of the causal sequences in the developmental process they are unable to comprehend when, why, and how we

should intervene in the lives of young children. The end result is that people either see early childhood as a period in which the primary goal is to protect the child inside the "family bubble" or to require children to develop on their own (what we have termed elsewhere "baby bootstrap"). In either case, as prior FrameWorks research has shown, the dominant frame of early childhood development runs counter to the developmental perspective.

In recent years, FrameWorks has partnered with a cadre of scientists and policy analysts to develop a core story of early childhood for public understanding.[iii] The core story, once developed, was then subjected to a phase of qualitative research to further refine it prior to this more specific phase of experimental testing. The goal of this work is to use communications research to aid public understanding of early child development. The implicit assumption is that if people have a better grasp of important scientific discoveries in neuroscience, they will place a premium on policies and programs that effectively promote a developmental perspective. Put differently, can framing the science of early child development more intentionally and coherently increase support for a developmental policy agenda? By activating certain ways of thinking, we argue, people can indeed overcome the common cognitive barriers to understanding the science of early brain development; and, more importantly, apply this thinking to the evaluation of early child development policies and programs.

In *"The Science of Early Childhood Development: Closing the Gap Between What We Know and What We Do"*, the authors maintain that there are "…a set of core developmental concepts that have emerged from decades of rigorous research in neuroscience, developmental psychology, and the economics of human capital formation" (Center on the Developing Child, 2007: 4). For the purposes of this report, we paraphrase and label four core developmental concepts:[iv]

1. *Prosperity* – Child development is a foundation for community and economic development. All facets of human capital are formed by abilities developed early in life.
2. *Skill Begets Skill* – Developing brains are built during a succession of "sensitive" periods associated with the development of particular circuits related to specific abilities. The development of increasingly complicated skills is built on the skills formed earlier.
3. *Pay Now or Pay Later* – Every homeowner knows that a house built with faulty wiring leads to costly repairs down the road. Likewise, the failure to insure that a young child's brain circuits are properly wired leads to lifelong learning and behavior problems.
4. *Can't Do One Without the Other* – Cognitive, emotional and social capacities are tightly connected throughout the life course. Being an interactive organ, the brain utilizes some functions to enrich others. Language acquisition, for example, relies on hearing, the ability to differentiate sounds, and the ability to pay attention and engage in social interaction.

The upshot is that these concepts, in turn, have significant consequences for public policy and the practice of early child development.

In "*A Science-Based Framework for Early Childhood Policy*", The National Forum on Early Childhood Program Evaluation argues that advances in the applied sciences make it possible to design interventions and program analyses that can have a significant impact on positive child development. In other words, the compilation of a large body of empirical work over the last forty or so years is instructive in answering the questions of when and how to intervene to produce favorable outcomes for children. The Forum talks about this as the "science of program evaluation" or what we have labeled *Evaluation Science*. This approach makes for smarter decisions among competing programs, thus allowing the most successful programs to be replicated and brought to scale. In all, adding the four core concepts from the neuroscience to the evaluation science forms the basis for framing early child development.

Connecting this to our prior discussion of framing theory leads to the following hypotheses:

H1: Compared to the control condition, exposure to the core scientific story of early child development will increase the salience of children's issues and heighten support for developmental policies and programs.

H2: Frame effects will be attenuated among people with strong prior beliefs about children's issues. Women and those people for whom children's issues are already salient will be least affected by exposure to the early child development frame. [v]

H3: Frame effects will be the greatest when additional information to the core story is symmetrical. Frame-confirming information will produce greater effects than frame-neutral or frame-disconfirming information.

Design and Measurement

This study, part of a larger research program, examines the impact of five key features of the science of early childhood development on public attitudes and policy preferences. Nine hundred and twenty four respondents were recruited to participate in an online experimental study. Two key issues are raised by our web-based experimental approach – causality and generalizability. It is widely known that the comparative advantage of experiments is in the capacity to generate persuasive evidence of causation; particularly compared to the inability of public opinion surveys to secure communications-related effects.[vi]

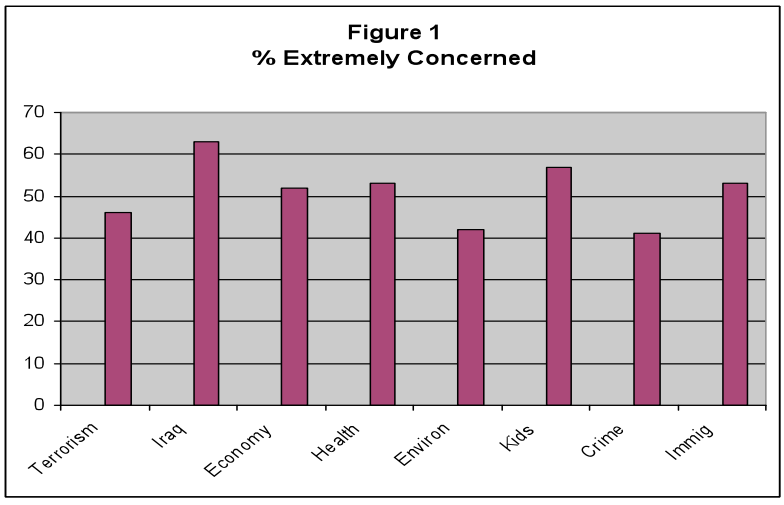
On the other hand, experiments generally suffer from limited generalizability because of their reliance on convenience samples.[vii] To get around the problem of generalizability but retain the causal power of experimentation, communications researchers have turned to a new generation of online samples. In our case, we have collaborated with the

Political Communications Laboratory (under the direction of Dr. Shanto Iyengar) and Polimetrix (under the direction of Dr. Douglas Rivers) at Stanford University to sample from national research panels.

The sample is built on two million online panelists who are incentivized (through various lottery-based awards) to participate in research studies. Although the volunteer panel is clearly not representative of any population, Polimetrix has developed a two-stage matching methodology which allows researchers to derive representative samples from a self-selected panel. The matching methodology takes two steps. First, a conventional national random sample is drawn utilizing a random digit dial (RDD) sampling frame. At the second stage, Polimetrix mirrors the conventional sample by selecting panelists who most closely resemble each member of the random sample on a set of demographic attributes (age, education, gender, ethnicity, and imputed political ideology). The use of sample matching, in effect, allows us to leverage the explanatory power of experiments with the more generalizable sampling framework of a national survey.

Finally, we should note that the populations we are most interested in are the politically and civically engaged. To the extent that it is safe to assume that elected officials and policymakers pay attention to the politically engaged, our focus on these populations is appropriate.[viii]

Study participants were invited to participate in a study of their opinions about "issues in the news these days." They were randomly assigned to one of five treatment conditions corresponding to a particular element of the core scientific story as discussed above. The treatment condition – consisting of a paragraph of text -- was encountered immediately after participants answered a series of questions probing their level of concern about current political issues. The responses to these questions (which could not have been affected by the experimental manipulation) are displayed in Figure 1. Interestingly, the percentage of participants saying they were very concerned about the well-being of children ranks next to concern about the war in Iraq as the most salient issue. We will return to this point a little later in the analysis.



As noted above, the sole difference between the versions of the "treatment" paragraph to which people were exposed was a paragraph of text describing the essence of each element of the core story. The five experimental conditions are: *Prosperity; Pay Now or Pay Later; Can't Do One without the Other; Skill Begets Skill; and Evaluation Science*. The exact wording of the treatments is found in Appendix A.

Dependent Measures

Participants completed a post-stimulus survey which asked a number of questions about the salience of children's issues as well as their preferences regarding a number of developmental policies and programs.[ix] The post-test items were pre-tested on a sample of 118 online participants. We factor-analyzed the measures to assess underlying commonalities. This procedure resulted in the development of five scales that were tested for inter-item reliability. Items were reflected, where appropriate, so that each scale represents levels of support for the developmental perspective.[x] The five dependent measures are: *Salience; Supports; Settings; Standards; and Chemicals*. Each represents a different part of the developmental agenda. For example, *Salience* captures the degree to which people value children's role in the society; *Supports* refers to the policies and programs that constitute the environment of the developing child (e.g., EITC); *Settings* concerns the regulations and licensing of early child care centers; *Standards* focuses on upgrading the early care workforce and bureaucracy; and *Chemicals* seeks to reduce toxins in the child's environment by banning things like pesticides and requiring labeling on dangerous products. Taken together, this is a clear representation of the developmental policy agenda.

Results

Study1: Our first analysis examines the impact of exposure to the core story on public attitudes and preferences. To accomplish this we collapsed all five treatments and compared them to the control condition. In other words, is getting any part of the core story better than not receiving the core story at all? We used simple ANOVA to test for a difference in mean scores between the treatment condition and the control condition. These results are displayed in Table 1. [xi]

Table1: The Impact of Exposure to the Core Story of Early Child Development on Public Attitudes and Policy Preferences

(Mean scores)

Indicators	Control	Core Story	F	N
Salience	0.66	0.73	4.2 **	686
Supports	0.63	0.71	7.0 **	760
Settings	0.63	0.67	1.2	653
Standards	0.63	0.68	2.4	546
Chemicals	0.74	0.76	0.3	711

Our initial hypothesis is partially supported. In all five instances, the mean score in the exposure (experimental) condition is higher than in the control condition. The differences were only statistically significant, however, in two of the cases. Exposure to the core story significantly heightened - by about seven or eight percentage points - *Salience* and *Supports* (increased backing for policies that improve the conditions in which families raise children). While these gains may appear modest, it must be remembered that they were produced by a very brief exposure to the stimuli.

Although these results are encouraging, they tell us nothing about the independent effects of different parts of the core story frame. In other words, are some parts of the frame stronger than others? To answer this question, we decomposed the core story into its constituent parts. Using omitted dummy variable regression (and controlling for the rather large and unsurprising influence of political party affiliation); we are able to assess the impact of exposure to different parts of the core story – relative to the control condition - on public attitudes and preferences. Table 2 presents the results of these calculations.

Table 2
The Impact of ECD Frames on Attitudes and Policy Preferences
Omitted Dummy Variable Regression controlling for Partisan Identification
(Unstandardized regression coefficients)

Frames	Salience	Supports	Settings	Standards	Chemicals
Prosperity	0.03	0.07**	0.02	0.07**	0.03
Pay Now	0.06*	0.07**	0.02	0.04	0.05
Can't Do	0.08**	0.09**	0.02	0.06*	0.03
Skill	0.06	0.05	-0.01	0.02	-0.01
Eval Sci	0.03	0.04	-0.02	-0.01	-0.06
N	668	743	637	534	695
adj. R2	0.28	0.26	0.21	0.20	0.25

* p < .05; ** p < .01

Several findings emerge from this analysis. The first is that 18 of the 20 coefficients have signs in the expected direction. Second, exposure to *Can't Do One Without the Other* significantly increases support for three of the five policy batteries. For example, people exposed to this treatment have mean scores for the Support scale (EITC, etc.) 9% higher than participants in the control group. This is particularly noteworthy given the conventional wisdom among many early child development advocates that people have a difficult time understanding the interaction between social, emotional, and cognitive development. A third feature of these data is exposure to *Prosperity* and *Pay Now* increases support for two of the five dependent measures. Fourth, there are few if any frame effects on the measures of *Standards* and *Chemicals*. This is not that surprising for *Standards,* given the rather technical nature of the questions. Indeed, more respondents opted not to answer the questions in this battery than in any of the others. The finding for *Chemicals* is a bit more surprising, given the relative salience of the issue; that is, the fact that more people were willing to answer this item and respond affirmatively. We will reserve judgment on this item until further analysis. Finally, three of the five coefficients for the *Supports* battery are statistically significant and the other two are close to significant. This is important because many advocates believe that gaining support for traditional anti-poverty programs is exceedingly difficult. In all, some parts of the core story are stronger than others.

To test our second hypothesis – that framing effects are moderated by individual predispositions – we performed ANOVA analysis by entering variables for gender and children's well-being along with the collapsed treatment variable utilized earlier in the analysis. Thus we are testing whether frame effects from the core story are moderated by prior dispositions, as represented by gender and attitudes about the importance of kids. These results are presented in Table 3.[xii]

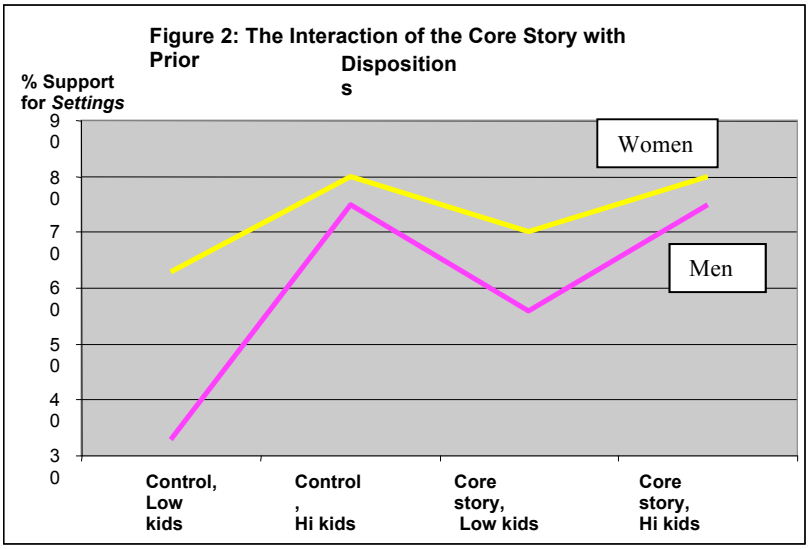
Table 3
The Interaction of the Core Story with Prior Dispositions

	Core Story * Gender		Core Story * Kids' Well-being	
	F	N	F	N
Salience	2.6*	686	2.6*	686
Supports	1	759	1.5	759
Settings	5.8***	652	4.0**	682
Standards	2.6*	545	1.4	545
Chemicals	1.5	711	0.11	711

* $p < .10$; ** $p < .05$; *** $p < .01$

In the main, the findings support our hypothesis: framing effects are moderated by gender and people's prior dispositions about the well-being of children. Put differently, women and people who prioritize the well-being of children (regardless of gender) were unaffected by exposure to the core story because they already exhibit high levels of support for the developmental agenda. On the other hand, men and people who placed a lower priority on the well-being of children were most influenced by exposure to the core story. Of particular note is the result that the moderating influences are most visible on the *Settings* battery. This may be explained by the fact that this battery focuses more than any other on the direct care of children. People for whom children are not a priority and men, many of whom do not equally share in child-rearing (a generalization but closer to right than wrong), become much more attuned to the need for conditions in early child care settings to be regulated and properly enriched.

These findings beg the question of a "double-whammy" effect. That is, are framing effects most pronounced among men? Given that the strongest two-way effects were for the *Settings* battery, the decision was made to use this measure to test the "double-whammy" hypothesis. The results for this analysis are displayed in Figure 2. The three-way



interaction (treatment X gender X well-being of children) is not quite significant ($F = 2.1$; $p < .17$). There is, however, a statistically significant difference between men in the control condition and men expressing high levels of concern in the treatment condition ($t = 3.4$; $p < .05$). This suggests that the framing effects are most pronounced among men when taking their prior beliefs about children into consideration. Put differently, men with lower levels of concern about the well-being of children are the most influenced by exposure to any element of the core story such that they exhibit higher levels of support for *Settings*.

Study 2: We designed a second study to test the hypothesis that framing effects are amplified by a consistent flow of information. Put differently, if additional information is provided to the base frame, does it matter if it is confirming or disconfirming? Based on work in cultural anthropology and cognitive linguistics, we utilize the concept of *simplifying models* to answer this question.[xiii] The fundamental assumption of this thinking is that there are shared understandings that we rely on to make sense of our world. These understandings are often conveyed by metaphors and vivid analogies that concretize more abstract phenomena. For example, "the heart is like a pump" or "ozone depletion is like a hole in the roof of the sky" represent the kind of concretized analogies that condense complex, expert knowledge. Thus simplifying models offer a particularly useful mechanism for clearing up facts that people may have previously learned but that are not organized in a coherent manner in their minds (FrameWorks Institute, 2002).

For these models to be effective, however, they must be easily learned and conveyed through brief exposure, and easy to present in multiple formats (e.g., visually, orally). In other words, not all simplifying models are effective communications tools. When used effectively, however, they can provide people with valuable mental shortcuts for processing, retaining, and applying incoming information.[xiv]

Earlier FrameWorks research identified two simplifying models with the potential to aid thinking about early childhood development. The first, *Brain Architecture*, has been well-tested (see Bales, 2005) and found to be an effective way to communicate certain parts of the core story.[xv] The second, *Effectiveness Factors*, is more speculative and tied to the research on program evaluation undertaken by the *National Forum on Early Childhood Program Evaluation*. The goal of this model is to make clearer the connection between the more complex practice of evaluation science and the more concrete notion that there are several factors that we can actually measure to make judgments between programs that work and those that don't. We hypothesize that this will lend a sense of agency and efficacy to the developmental story. The question then is, does additional information enhance or attenuate frame effects?

To address this question we conducted a second study utilizing a 5 X 2 fully crossed design. Study participants were randomly assigned to one of 10 treatment conditions. As in Study 1, participants completed a pre-test questionnaire, a two-paragraph treatment text, and a post-stimulus questionnaire. The only element that differed among the participants was the version of the treatment text that they read. For each of the five elements of the core story (*Prosperity*, *Pay Now*, *Can't Do One Without the Other*, *Skill Begets Skill*, *Evaluation Science*), respondents were assigned to either a *Brain Architecture* condition or an *Effectiveness Factors* condition (see Appendix C for the exact wording of the treatments).

Our prediction is that framing effects will be most pronounced when the information stream regarding the core story is consistent.[xvi] That is, when the model confirms the core story as found in each of the elements. We would expect framing effects to be the greatest when:

1. *Brain Architecture* is paired with *Can't Do* and *Skill* because these are the two elements of the core story that have the most to do with the circuitry of the developing brain.
2. *Effectiveness Factors* is paired with *Evaluation Science* and *Pay Now* because both of these elements refer to cost effectiveness.

Finally, we anticipate no additional frame effects when the core elements are paired with the *Prosperity* frame, given its prima facie disconnection from either of the two simplifying models.

Testing this requires us to construct two variables. In the first instance, we created a five-point item for people exposed to each of the five elements of the core story, regardless of the model to which they were exposed. The second is a two-point variable that represents participants exposed to each of the two models, regardless of the story element to which they were exposed. This configuration allows us to perform an ANOVA test for the interactive effects of adding the models to the core story. The results of this analysis are reported in Table 4. Three of the five tests are statistically significant and a fourth

Table 4. The Interaction of Core Story Frames with Simplifying Models on Public Attitudes Preferences about Early Child Development

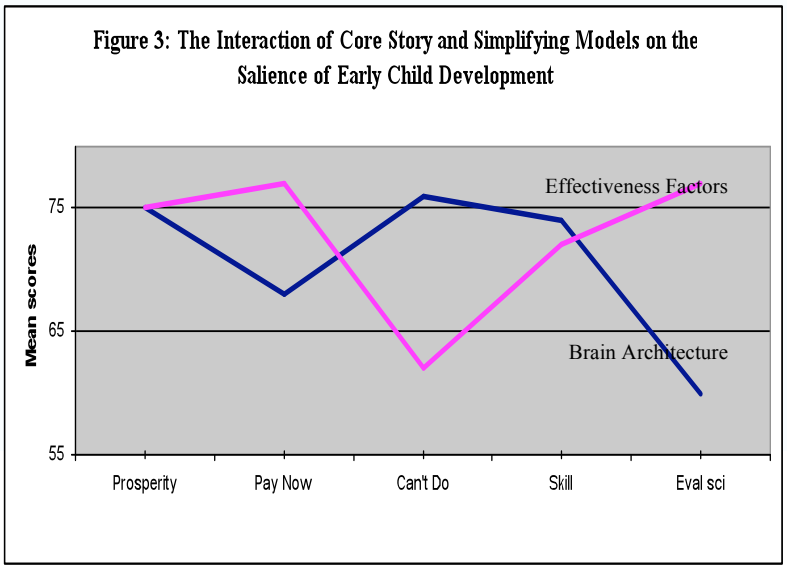
ANOVA

	F		N
Indicators			
Salience	3.8	**	351
Supports	3.2	*	397
Settings	2.1		335
Standards	0.6		280
Chemicals	3.8	**	379

* p < .10; ** < .05

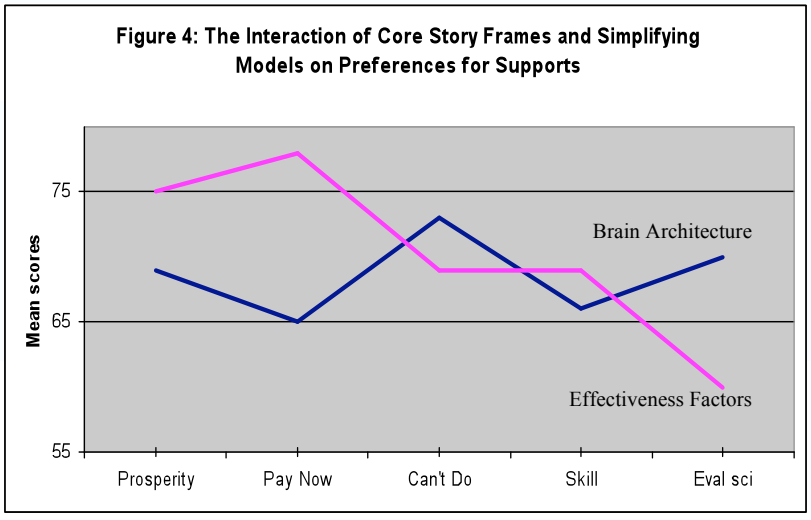
approaches significance. That is, there are frame effects for the interaction on *Salience*, *Supports*, and *Chemicals*. An analysis of the means for these measures permits us to evaluate the accuracy of the frame confirmation hypothesis. Figures 3-5 capture these effects. For each of the significant interactions, we plot mean scores for participants exposed to the two models for each of the five framing elements. Figure 3 displays the

interaction for the Salience measure. Here we see that confirming information heightens salience, while disconfirming information depresses salience. Put differently,

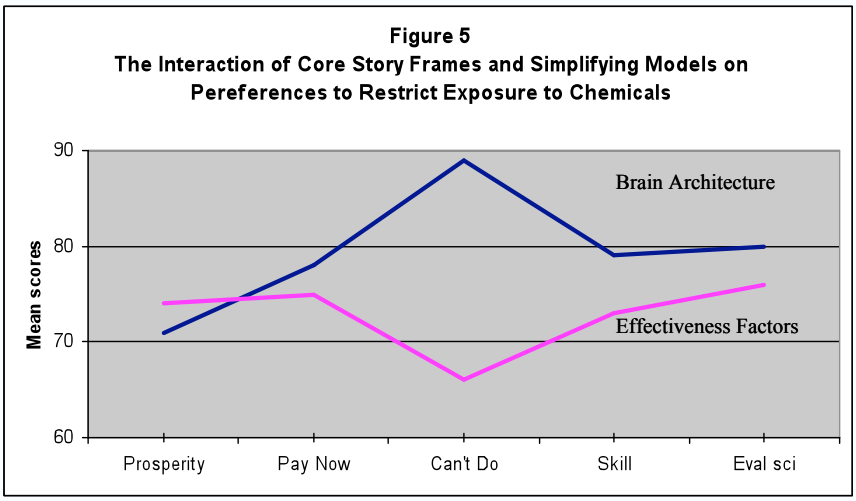


when the *Brain Architecture* model is added to either *Can't Do* ($t = 3.2$; $p < .05$) or *Skill Begets Skill* ($t = 1.6$; $p < .12$), frame effects increase; likewise, when the *Effectiveness Factors* model is added to either *Pay Now* ($t = 1.3$; $p < .17$) or *Evaluation Science* ($t = 3.7$; $p < .01$), frame effects increase.[xvii] As expected, the simplifying models add no value to the framing effects of the *Prosperity*.

The results for the *Supports* battery, however, are decidedly more mixed. Figure 4 shows that adding *Effectiveness Factors* to *Pay Now* does significantly magnify frame effects ($t = 2.3$; $p < .05$). On the other hand, the other effects are weak (*Can't Do*) or in the wrong direction (*Skill and Evaluation Science*). Indeed, *Brain Architecture* significantly magnifies *Evaluation Science* contrary to expectations ($t = 1.9$; $p < .07$). It appears that once primed with the idea that there is a rigorous method for choosing between programs, the addition of information about the developing brain becomes more relevant for thinking about programs like EITC.



The findings for the final interaction are shown in Figure 5. Here the noteworthy finding is the dramatic impact of adding information about the developing brain to the idea that children's social, emotional and cognitive development is interconnected. It is as if



people realize that exposure to toxins really does have an adverse impact on a child's development. That is, the simplifying model appears to concretize the idea that there are things in a child's environment that can corrode and retard development. In this case, support for restricting toxins reaches upwards of 90%.

In all, there is mild support for the hypothesis that communications streams must retain consistency in order to maximize framing effects.

Summary and Discussion

At base, this report asks if complex scientific phenomena can be effectively communicated to the general lay public. The short answer is yes. Using carefully controlled online experiments, we show that careful framing of the science of early child development can significantly influence the public's attitudes and policy preferences about the allocation of resources for children's issues. We build an analytic framework

on literatures in the cognitive and social sciences to develop a theoretical perspective about framing effects in public communications. More specifically, we hypothesize that exposure to the core scientific story of early child development will increase the salience of children's issues and heighten support for developmental policies and programs. We expected these effects, however, to be moderated among people with strong prior beliefs about children's issues. We also anticipated that frame effects would be the greatest when additional information to the core story is symmetrical.

There is strong support for our first two hypotheses but more limited support for the third. We found that framing effects were greatest for the level of importance people attach to children's issues and for traditional social welfare programs like EITC and aid to low-income pregnant women. This is interesting, given the conventional wisdom that the American public has turned away from these issues. Framing effects were weakest on questions about restricting exposure to chemicals and toxins in the environment. We speculate that the complexity of the questions and the technical nature of the issue may be the cause of these weak framing effects.

We discovered that it matters which part of the core story one tells. For example, framing effects were stronger and more consistent for the core element that articulates the connection between the social, emotional, and cognitive development of children. This finding is interesting, given that many advocates have found this to be among the hardest messages to communicate. Another way to think about this is that the fundamental assumption of No Child Left Behind policies is that you can, in fact, focus on only one aspect of the child (their cognitive development). Our findings should be good news to those who believe that the most effective policies and programs address the whole child.

We also found strong support for the notion that chronically accessible beliefs play a moderating role on framing effects. Framing effects were moderated among people with strong priors about kids – either those who self-identify as such or women. In substantive terms, it is likely that they simply do not need the core story to exhibit high levels of support for the developmental agenda. On the other hand, men and people with lower levels of concern about children are influenced by framing effects. This, it would seem, has strong strategic implications for ECD advocates.

Finally, we report mixed results on the question of whether it is better to remain consistent in the communications stream when talking about early child development. We found some support for the hypothesis when it comes to questions of salience (and to some degree to the question about toxins in the environment), but found weaker effects for the other dependent measures. It is quite possible that our methodology is not particularly well-suited to confirming the effectiveness of simplifying models – which have been developed through their own protocol of qualitative methods. Indeed, if good simplifying models have high fidelity and are thus viral, our approach would not seem to be as well-suited as these qualitative techniques. Nonetheless, we did find some framing effects as a result of exposure to the simplifying models.

In all, effective framing of early child development has the capacity to heighten the salience of, and increase support for, the developmental perspective. The fact that translating science accurately can have a beneficial effect on public understanding and support should provoke a re-examination of current practices in the public communications of early childhood policies.

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Appendix A:
Study 1 Treatments

Study 1 participants were randomly assigned to one of five experimental treatment conditions. The treatment condition was placed immediately following the pre-test battery. The structure and relative length of the text was held constant across the experimental conditions. Thus each paragraph has the same introductory and concluding text. We manipulated five to six lines of text in the middle of each paragraph to reflect the treatment.

Prosperity
Lately there has been a lot of talk about the role of children in the society. In particular, people have offered various explanations of why it is important to devote societal resources to children at the very earliest stages of life. For example, some people believe that child development is important for community development and economic development. According to this view, society's ability to build on capacities that are developed during childhood become the basis of a prosperous and sustainable society -- from positive school achievement to work force skills to cooperative and lawful behavior. Have you heard of this explanation of why we should allocate societal assets to young children?

Pay Now or Pay Later
Lately there has been a lot of talk about the role of children in the society. In particular, people have offered various explanations of why it is important to devote societal resources to children at the very earliest stages of life. For example, some people believe trying to change behavior or build new skills on a foundation of brain circuits that were not wired properly when they were first formed requires more work and is more "expensive." According to this view, remedial education, clinical treatment, and other professional interventions are more costly than the provision of nurturing, protective relationships and appropriate learning experiences earlier in life. Have you heard of this explanation of why we should allocate societal assets to young children?

Can't Do One without the Other
Lately there has been a lot of talk about the role of children in the society. In particular, people have offered various explanations of why it is important to devote societal resources to children at the very earliest stages of life. For example, some people believe that paying attention to young children's emotional and social needs as well as to their mastery of literacy and cognitive skills has the maximum impact on child development. According to this view, because the brain is a highly integrated organ and its multiple functions operate in a richly coordinated fashion, you cannot focus on developing just one part of the child without paying equal attention to the other capacities. Have you heard of this explanation of why we should allocate societal assets to young children?

Skill Begets Skill

Lately there has been a lot of talk about the role of children in the society. In particular, people have offered various explanations of why it is important to devote societal resources to children at the very earliest stages of life. For example, some people believe that children's brains are built "from the bottom up," with simple circuits and skills providing the scaffolding for more advanced circuits and skills over time. According to this view, the circuits that underlie the ability to put words together to speak in phrases form a foundation for the subsequent mastery of reading a written sentence in a book. Have you heard of this explanation of why we should allocate societal assets to young children?

Evaluation Science

Lately there has been a lot of talk about the role of children in society. In particular, people have offered various explanations of why it is important to devote societal resources to children at the very earliest stages of life. For example, some people believe that by requiring the application of the most rigorous program evaluation science to new children's programs we can make smarter decisions among competing programs and we can replicate the successes. According to this view, constantly updating our understanding of what works for children at different stages of development provides the best long-term return on society's short-term investments in children. Have you heard of this explanation of why we should allocate societal assets to young children?

Appendix B:
Dependent Measures

Salience
The U.S. Congress voted to cut $35 billion from such programs as federal student loans, Medicaid and child health programs, and child care – and President Bush proposed further cuts in this year's budget. Do you favor or oppose cuts like these? (If favor/oppose) Do you strongly (favor/oppose) these cuts, or only somewhat?

When you think about all of the issues facing the country, how important is it for you that candidates for office provide a comprehensive agenda describing what they would do to meet the needs of children, youth, and families – very important, somewhat important, not too important, or not important at all?

And do you agree or disagree with the following statement: "It is society's responsibility to make sure all children have the opportunity to succeed, and it is important for government to invest in children's programs proven to reduce child abuse, improve child health, and better educate our children." Do you agree or disagree with that statement? (If agree/disagree) Do you strongly or only somewhat (agree/disagree) with that?

Supports
Decades of scientific research suggests that persistent poverty in the early years of life is a powerful predictor of lifelong disparities in educational achievement and health. Policymakers and private employers have offered several potential solutions to this problem. For each of the following, please tell us if you strongly favor, favor, do not favor, or strongly do not favor the particular solution:

- Expand tax credits, such as the Earned Income Tax Credit and Dependent Care Tax Credit, to better support working poor parents and their children.

- Increase funding for employment support programs that are designed to reward full-time work with larger paychecks for employees with dependent children.

- Assure that all pregnant women, mothers, and children have basic health insurance and access to health care.

Settings
Access to high quality settings for infants and toddlers - environments that provide individualized nurturing and rich learning experiences - is a particular hardship for working class families whose incomes exceed the eligibility threshold for programs such as Early Head Start, as well as for low income families who do not have access to higher-quality child care or early intervention programs. Policymakers and private employers have offered several potential solutions to this problem. For each of the following, please

tell us if you strongly favor, favor, do not favor, or strongly do not favor the particular solution:

- Restricting child care subsidies to settings that are licensed, regulated, and monitored by the states, which is not required currently by federal child care legislation.
- Increasing access to Early Head Start and other comprehensive, high-quality settings for vulnerable infants and toddlers.
- Providing mechanisms for unregulated child care settings, such as those in relatives' homes, to be incorporated into regulatory systems.
- Providing incentives in voucher and taxation systems to encourage the use of programs that meet high quality standards.
- Conducting public education campaigns about the critical importance of stimulating and nurturing environments in the early years of life.
- Insuring that all public funds allocated for early care and education are invested in environments that meet baseline standards for health and safety, particularly in the first three years of life.
- Requiring states that fund early child programs to include, and share with the public, rigorous evaluations of the effects of various program designs.

Standards

Neuroscience makes it very clear that excessive stress in early infancy can disrupt the development of the brain in ways that lead to long-term and costly problems in learning, behavior, and both physical and mental health. Below are several strategies to reduce children's stress hormone levels. For each of the following, please tell us if you strongly favor, favor, do not favor, or strongly do not favor the particular intervention:

- Intensive home visiting by highly trained professionals when needed.
- Skilled counseling for mental health problems.
- High quality support services for parents in group, parent-child, or individual settings.
- Substantial public investment in professional training, and improved recruitment, compensation, and retention of a high quality early child workforce.
- Creating direct linkages between early intervention services – such as, developmental screening of infants and toddlers -- across all agencies that administer public assistance programs, such as child protective services.

Chemicals

Scientific evidence indicates that exposure to certain chemical substances during the period from conception through the early years of life can cause significant and irreversible damage to the developing architecture of the brain of an embryo, fetus, or infant at levels that appear to be harmless for adults. The following are proposals to reduce the number of children whose brains are seriously harmed by environmental

toxins. Rate each proposal on a scale of one to five, with five being the highest score and one being the lowest score:

- Impose new restrictions on environmental mercury.
- Reduce the emissions of coal-burning power plants and incinerators.
- Prohibit the use of any pesticides at a school or child care center unless it has a program that focuses on non-pesticide alternatives to chemical compounds.
- Prohibit the use of any pesticides at a school or child care center unless the parents have been notified in advance.
- Expand public awareness by requiring the dissemination of accurate scientific information on warning labels.

Appendix C
Study 2 Treatments

Brain Architecture

Over the last several years technological and scientific advances have greatly benefited the study of the human brain. There is now strong evidence to suggest that the basic architecture of the brain is constructed through an ongoing process that begins before birth and continues into adulthood. Much like the construction of a home, the architecture of the developing brain begins with laying the foundation, framing the rooms, and wiring the electrical system; and continues with the incorporation of distinctive features that reflect increasing individuality over time. Please tell us if you have heard of the idea of the "brain architecture".

Effectiveness Factors

Over the last several years the science of program evaluation, driven by social scientists and economists, has greatly benefited the study of the impact of programs on young children. There is now strong evidence to suggest that we can measure what scientists call "Effectiveness Factors" that often make the difference between programs that work and don't work to support children's healthy development. For example, for 3 and 4 year olds, these would include the level of teacher training, a language-rich environment, and a safe and regulated learning environment. Without these Effectiveness Factors, some children can spend just as many hours in a program, but not show many positive outcomes. Please tell us if you have heard of the idea of the "Effectiveness Factors".

[i] Some scholars contend that people are much more deliberative and conscious in their consideration of the appropriate response than the "automaticity" model of accessibility asserts (see Druckman, 2004; Higgins, 1996; Miller and Krosnick, 2000).

[ii] See, for example, Aubrun and Grady, 2002 2003; Bales, 2005; Bostrom, 2002; Gilliam, 2006.

[iii] The National Scientific Council on the Developing Child, the National Forum on Early Childhood Program Evaluation, and the Center for the Developing Child, Harvard University.

[iv] Two pieces of the core story are reserved for future analysis. The first is the notion that toxic stress in early childhood has pernicious effects on the nervous system (Center for the developing Child, 2007a:9-10). The second is that the interaction of genes and experience shape the architecture of the developing brain (Center for the Developing Child, 2007a: 6-7).

[v] To expect gender effects is hardly surprising, For instance women were almost 20% more likely than men in our sample to report being extremely concerned about the well-being of children ($mean_w$ =.66, $mean_m$ = .47; F = 35.1, p < .001).

[vi] See Kinder (2006) for an interesting essay on the ways in which experimentation aids and constrains our thinking.

[vii] See Iyengar (2004) for a concise review of online experimentation.

[viii] The demographics of our sample are: 44% Democrats; 23% Liberals; 53% Women; 80% White; and 31% College graduates.

[ix] These items were developed from two recent reports: National Scientific Council, *The Science of Early Child Development* (2007); and the Center for the Developing Child at Harvard University (2007) *A Science-Based Framework for Early Child Policy: Using Evidence to Improve Outcomes in Learning, behavior, and Health for Vulnerable Children*.

[x] We standardized the items for ease of comparison. First we created a new variable (N_1) by summing the individual items ($I_{1....n}$) and dividing by the sum total of items E(I). We then created a new variable (N_2) = (N_1-1)/R, where R equals the range of N_1.

[xi] A noticeable feature of the table is the reduction in the number of cases. This is the result of participants not responding to the dependent measures. Indeed, the number of missing values is much higher than other online experiments we have recently conducted. We attribute this, at least in part, to the complexity of the policies and programs under consideration. This interpretation is supported by the observation that people didn't answer on the questions of *Standards* but were more likely to answer questions about *Supports* and *Chemicals*, prima facie, two areas that are a little more direct. We examined the possibility of using a mean replacement of missing values procedure but found that it destabilized the standard errors. Given that we don't actually know the attitudes of those who did not answer we took the more prudent route of reporting the cases with complete data.

[xii] We used the pre-test about levels of concern for children's well-being (discussed earlier in the report) and dichotomized it between those who were "extremely concerned" (57%) and everyone else.

[xiii] Simplifying models (Aubrun, Grady, and Bales, 2005; Aubrun and Grady, 2003) are an adaptation of several related constructs, including cultural models (D'Andrade, 1981; Holland and Quinn, 1987); mental models (Johnson-Laird, 1983, 2006); and metaphors (Lakoff and Johnson, 1979; Lakoff, 1996).

[xiv] See Aubrun and Grady, 2003; Quinn, 2005; and O'Neill, 2007 for discussions of how to measure and test simplifying models.

[xv] The basic idea is that the process of the developing brain is like the process of home building. When designing and building a home, one carefully follows a sequential and iterative process. In other words, the order in which the project develops matters (e.g., you don't drywall before wiring for electricity) and each step has consequences for future steps. Using cheap wiring or plumbing in a 3 million dollar house is a sure way, at some point, to be sitting in a dark and flooded mansion.

[xvi] In our preliminary analysis we tested the hypothesis that simply getting more information enhanced framing effects. The data, however, did not support this contention. There was no difference across all five dependent measures between people who were exposed to just the core story and those who were exposed to the core story and the simplifying model.

[xvii] Reported t-tests are for the difference in means between the two simplifying models conditions.