Determinism Leavened by Will Power: The Challenge of Closing the Gaps Between the Public and Expert Explanations of Gene-Environment Interaction

A FrameWorks Research Report

Prepared for the FrameWorks Institute

by

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INTRODUCTION

The research presented here was sponsored by the Center on the Developing Child at Harvard University and represents the latest iteration of a larger body of FrameWorks research that seeks to advance more effective ways of communicating the core story of early childhood development. This report is the beginning of a new line of this research exploring ways of communicating a particularly important but complex part of the core story of early child development to the public — *gene-environment interaction*.

When scientists talk about gene-environment interaction, they are referring to the relationship between an individual's DNA and the wide range of contextual factors that comprise the environments they live in and experience. Illuminating the science of this interaction helps us understand how children develop, why they experience the outcomes they do — their physical characteristics, behaviors, personality, skills and abilities — and account for the differences that exist between individuals. However, because of the complexity and technical nature of how genes and environments interact, it has been difficult to communicate both the science of this interaction and its importance.

In this report, we investigate how scientists conceptualize individual differences, the influences of and interactions between genes and environments, and how these concepts fit into the larger story of early child development. We also look at how the public thinks about and understands these same concepts and ideas. FrameWorks' overall aim is to narrow the gap between how Americans *think* and experts *talk* about the determinants of individual outcomes and differences, and the importance of genes and environments in how children develop. In short, we seek to make the scientific understanding of this interaction and its policy implications more accessible to the general public.

This report is a foundation for subsequent research that develops and tests specific strategies to translate and reframe the scientific understanding of genes and environments for lay consumption. The full scope of this project includes an array of methods associated with the Strategic Frame Analysis™ approach: cultural models interviews, focus groups, media content analysis, cognitive media content analysis, Simplifying Models[1] development and empirical testing of our frames using experimental surveys. This report is a part of the first phase of research specifically focused on gene-environment interaction. In this report we use both descriptive and cognitive interview techniques to identify conceptual differences in expert explanations of gene-environment interactions and how the public understands these phenomena. We divided this first line of inquiry into three phases that also serve as the organizational structure of this report: (1) the scientific discourse on gene-environment interaction; (2) the public understandings of the relationship between genes and environments; and (3) the comparison between these conceptions (see Appendix II for more on FrameWorks' methodological approach to "mapping the gaps").

[1] At FrameWorks, a Simplifying Model helps to bridge the gap between expert and lay understandings of an issue. Empirically tested, a simplifying model explains complex ideas using metaphors that facilitate thinking and understanding on an issue by helping individuals conceptualize and use new information in thinking about an issue. As such, simplifying models are a critical frame element.

SUMMARY OF FINDINGS

1. Scientists emphasized that individual outcomes and differences are the result of a complex interplay between genes *and* environments. Experts emphasized that the science of gene-environment interaction points clearly to the importance of quality developmental environments and, similarly, that the realization of genetic *potential* relies on the *interaction* of these influences. Expert messages point to the need for policies and programs that improve the quality of developmental contexts. Some scientists offered epigenetics as a way to explain the gene-environment interaction and to address public assumptions that diminish one side of the equation in favor of the other.

2. The predominant perspective of lay informants was that individuals ultimately are the way they are because of the amount of will power, conviction and determination that they posses. Informants also assumed that parental influences, and, to a lesser degree, genes, shape individual outcomes and differences — but that these forces were secondary to will power. In this way, cultural models interviews revealed three dominant cultural models that lay informants used to make sense of and think about the factors that shape individual outcomes and differences: (1) *will power is the ultimate determinant of outcomes and differences; (*2) *parents are environments;* and (3) *genes are set in stone*. All three models were evident in each of the 15 interviews.

3. Three less pervasive patterns of assumptions and understandings — what we call "recessive models" — also emerged from the cultural models interviews: (1) *environments modify predispositions; (*2) *drive is located in the brain;* and (3) *popular culture as a determinant.* These models represent more promising directions to explore in subsequent communications research.

4. Perhaps the most important finding from this research is that, while lay informants had clear and dominant models for understanding what factors influence outcomes and individual differences, these models occupied discrete and disconnected cognitive space. Informants had a clear understanding of *what* factors influence *what* outcomes — they saw specific factors linked to specific outcomes/differences — but were largely unable to conceptualize any interaction or interplay *between* factors. The lack of a model that informants could use to *integrate* the influences explains the observed difficulty in thinking and talking about *how* factors influence outcomes. This feature of the cultural models "swamp" — dominant assumptions about what is important, but the lack of a cognitive model through which to integrate discrete factors — represents a communications opportunity. Developing and disseminating a simplifying model that lays out the process-connection between genes and environments will likely provide the missing piece, allowing the public to see the *interaction* between genes and environments and become more receptive to public policies that influence this interaction.

5. Four gaps emerged between expert and public understandings. These areas represent promising locations for the development of simplifying models: (1) influences on outcomes and differences; (2) conceptions of environments; (3) gene-environment relationship; and (4) the impact of genes.

The remainder of the report proceeds as follows: We first discuss the expert interviews, reviewing the methods employed to gather and analyze these data as well as the research results. Next we present the method, findings and implications of the cultural models interviews that were conducted with lay informants. We conclude with a discussion of the specific gaps, or "cognitive holes," between the experts and lay audiences and a brief summary.

EXPERT INTERVIEWS

I. RESEARCH METHOD

Subjects

To locate appropriate experts who could articulate the latest scientific research on gene-environment influences and interactions, we first identified several scientists whose scholarship centers on this interaction within the broader field of early child development. These scientists then helped us to identify additional experts in the field who they believed would be able to provide additional insights in this area of research (snowball sampling). We cross-referenced the lists provided to us by these scientists and, based on the overlap (i.e., names that appeared on each list), selected five experts to interview. All five expert informants were white, two were women, and all hold research positions where they study issues related to the influence of and interaction between genes and environments. A total of five one-on-one interviews with the experts were conducted via telephone in December 2008. The interviews lasted approximately one hour and, with the participants' permission, were recorded and subsequently transcribed for review and analysis.[2]

Interviews

The interviews consisted of a series of probing questions meant to capture the scientific understanding of gene-environment interaction. In doing so, we guided the expert informants through a series of prompts and hypothetical scenarios designed to challenge them to explain their research, break down complicated relationships, and simplify concepts, methods and findings from the field. For example, in one exercise, experts were asked to imagine that they were speaking to a room of policymakers and were tasked with explaining how genes and environments interact to shape outcomes and the implications of recent research in this area for "average" Americans. In addition to the preset questions, we also probed experts for additional information that members of a hypothetical audience might ask in response to the initial explanations offered by the informant. In this way, the interviews were semi-structured

[2] Quotes provided in the report from informants have been lightly edited for readability, taking out stammers, repeated words and conversational fillers like "um," "uh" and "you know." For example, "I don't — I don't know if it's something he was…uh…just simply born with or, if he…you know…he could — he could have done a lot of others things than what he did, but now he's paying conse-consequences" becomes "I don't know if it's something he was just simply born with or, if he could have done a lot of others things than what he did, but he now he's paying the consequences." To ensure that we maintain the integrity of the quotes, multiple FrameWorks researchers reviewed the transcripts prior to analysis and presentation in the report.

collaborative discussions with frequent requests for further clarification, elaboration and explanation.

Frameworks also approaches expert interviews as an opportunity to elicit the distilling and clarifying concepts and metaphors that scientists routinely use to present their research to various audiences. In FrameWorks' past research on early child development more generally, the metaphors and concepts we were able to "mine" from experts have proven invaluable in developing strategies to translate the scientific research into digestible and impacting messages for the public.

Analysis

Analysis of the expert interviews employed a basic grounded theory approach.[3,4] In this approach, common themes are pulled from each interview and categorized; negative cases are incorporated into the overall findings within each category; and the result is a refined set of themes (categorized appropriately) that synthesizes the substance of the interview data in the broadest terms possible. In our use of this approach, the themes presented below explain and clarify foundational components of the "core story" of gene-environment influence and interaction. Consistent with this method, the themes we identified were then modified and appropriately categorized during each phase of the analysis to account for disconfirming or negating research presented by other scientists.

As such, what we present here is the more refined set of themes that emerged from this process. Together, these themes tell the story of the science of gene-environment influence and interaction.[5] In this way, they establish a baseline understanding to which all subsequent translations for lay audiences will be accountable.

[3] Glaser, B.G., & Strauss, A.L. (1967). The discovery of grounded theory; strategies for qualitative research. Chicago: Aldine Pub. Co.

[4] Strauss, A.L., & Corbin, J. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Newbury Park, CA: Sage Publications.

[5] In addition to synthesizing the basic themes in the science "story," we also gave some attention to identifying particularly illuminating metaphors that scientists employed both implicitly and explicitly in their interviews. As explained above, these metaphors are invaluable to FrameWorks in terms of suggesting a starting point for the development of the simplifying models portion of the Strategic Frame Analysis™ pursuit of core story elements to translate gene-environment interaction, individual differences and early child development more generally. We will outline these in future iterations of our research.

II. CORE THEMES, POLICY POINTS AND IMPLICATIONS

Core themes

1. A base of genetic material constrained or enabled by environmental influences
The most pervasive idea in our discussions with experts was that the way people are — from how tall they are to how they behave to how well they perform in school — can be ultimately attributed to a summation of genetic plus environmental factors. Experts explained that understanding how these forces work to influence and shape individual outcomes is at the core of understanding individual differences.

When tasked with explaining outcomes, experts used the idea that genes are what individuals *are given* and environments determine the "expression" of this material (a subtle implicit metaphor used by all five experts in interviews). Experts explained that even if individuals have relatively similar genetic material (i.e., family members, twins), the environment has the ability to *modify* the *realization* or *expression* of this genetic material. The assumption here was that individuals have unique genetic material, which can be, based on specific environmental or contextual influences, expressed or inhibited. The scientific model used by our experts in explaining genetic and environmental influences was *genes as basic materials and environments as enabling or constraining factors*.[6] The following explanation was typical across all expert informants and reveals this underlying concept.

> "… but why is it that my grandfather died at 52, and my mother is 87, and she is still alive with this identical inherited [heart] problem? So, what's the difference? Medications! Healthcare! These things are not inherited. These things are all *extrinsic*. These are all environmental factors that have allowed your system to adapt to the fact that you've got a component of your architecture that's weak."

However, when pressed to explain the *actual interaction — how* the external environments we live in affect the internal DNA in our bodies — to a non-technical audience, several of the experts struggled. When asked to explain to a public audience *how* environments "turn on or off" genes, expert explanations were highly technical, relying on descriptions of processes like methylization. Similarly, in responding to frequent probes to explain the environmental aspects of outcomes where the genetic influence was more readily apparent and vice versa, experts were proficient at explaining how the given outcome was shaped by both environmental and genetic factors — that both genes and environments played a role. But, in general, experts ran into difficulty in explaining *how* these two sets of influences *interacted* to determine outcomes. There were several notable exceptions discussed below, in which experts employed the idea of *epigenetics* in more accessible terms to explain how external environments affect internal genetics.

[6] This model is of particular note because of its consonance with a recessive model that emerged from the analysis of data from cultural models interviews with lay informants.

2. The epigenome as the link

When probed about the link and relationship between genes and environments, experts employed the concept of *epigenetics*. Some were able to explain this idea in non-technical terms while others struggled to relate this concept to non-scientific audiences. The example below illustrates this difficulty.

> "Well, there's DNA methyltransferases for example that comes in. There's separate genes that put the original programming down, and they are probably attached to, for example, other proteins that are recognizing motifs and these are signals from the outside. So in other words, early in development, some cell bumps into another cell, and releases a growth factor. That now stimulates a receptor that ultimately goes down to transcription factors that at some point are going to be involved with these DNA methyltransferases, and they are gonna methylate groups on things, and also all these auscultations on these cystines are going to occur because there's programs that read both things. So it's all done through proteins."

Scientists who were able to explain this process in less technical terms described the epigenome as being located in the internal cellular environment and described epigenetics as *the way* that genetic material is expressed through the coding of proteins that determine how our bodies work. They explained further that the epigenome is the main *place* that the environment "comes in" and permeates an individual. One scientist explained epigenetics using a causal sequence: The external environment directly affects the epigenome, which directly affects the way that genes get turned on and off and produce, or don't produce, the proteins, which ultimately determine how our bodies work. These experts explained that the epigenome as an "open line" to the environment or an "environmental switch" that is therefore sensitive to contextual influences. *In this way, the environment (through the epigenome) influences genes by signaling or controlling their operations.*

Experts overwhelmingly employed electronic metaphors in talking about how environments "turn on or off" genes and the relationship between genes, the epigenome and environments.

> "Our genome [is like] hardware. Basically that's the hand that we are dealt. If we've got 30 gigs on our hard drive, that's the capacity that we have. The [epigenome is the] software, that we *use* to manipulate that information … applying specific kinds of software to the hardware to get the hardware to function in a certain way. If you use software that's inefficient, your hardware is going to function inefficiently even though it has the capacity to function efficiently. It's the software that can change how well the hardware works."

> "The outside world really doesn't have a lot of influence on the part of the gene that encodes the protein itself. What the outside world *can* do is essentially be the hand on the volume switch on your iPod to turn it down, or turn it way up … it can also actually press the button and turn it *off* as well. That's where the major outside influences have their biggest impact on that part of turning those genes on or off, and determining or influencing when they get turned on, and when they get turned off."

The epigenome was explained as the "instructions" of what the cells need to do. The instructions are shaped by the external environment of experiences and exposures surrounding the individual.

> "I am going to tell you one thing right now … environments affect [the epigenome's] ability. Because this is where all the action is … when you're down at the DNA level, that actually makes it a lot simpler. I mean, what are you going to be changing? You're either mutating DNA, or you're just changing the programs [that read it]. It's not that hard."
>
> **Interviewer: And the environment is…**
>
> "It's the monkey wrench."
>
> "We know that forces from the outside have this impact on development and we know that it can be very powerful. How is it that it can have such long-lasting effects? We essentially remember what we experience. Let's say [when we were] two years old, at the level of our DNA. That is, our architecture has that information built into it now. How do we remember that? Well, the epigenome is essentially the handwriting … it's the signature for whatever the environmental influence was that changed the way that our inherited genes work. So, you know, it *changes* the chemical structure of our DNA. That's essentially the signature of the environment … and it's remembered for a long time."

In translating the interaction and influence of environments and genes, the idea that the epigenome is shaped by the individual's external environment and determines the way that the internal genes work, is promising. It represents the conceptual *link* between what goes on outside and what transpires internally at the genetic level — an essential process in realizing the importance of *environments in development*. Furthermore, as the link between genes and environments, a concept of epigenetics, once simplified and empirically tested, has the potential to allow the public to appreciate the fact that genes and environments *interact* in their influence on outcomes rather than just having separate and distinct effects. This again highlights the importance of environments in shaping outcomes and in accounting for individual differences.

3. Belief in the public's desire to see "percentages"

Experts assume that the general public understands gene-environment interaction in terms of *percentages* and as *discrete influences*. Experts explained explicitly and assumed more implicitly that the public has a strong desire and inclination to see genes and environments with respect to the relative percentages of influence that each factor has in determining ultimate outcomes. Experts viewed this "need" for neat percentages as unproductive and misleading. However, discussions of relative weights of influence are of considerable practical importance in the policy world where funding decisions are made based on an understanding of what outcomes are most susceptible to positive change (i.e., those highly determined by environmental/contextual inputs). So while percentages and relative weights of influence may be a difficult scientific question, it is a legitimate and important question for both those who make policies and the general public that experiences them.

> "You know, it's a hard thing because some experts still do it [think about percentages of influence]! So, I go to scientific meetings and there is *still* talk of how much something is genetic, and if I talk to geneticists — like very old-school geneticists about how maternal care can have this very strong influence on genes, they just want to understand *how much* of heritability is accounted for by what I've just said, or how that affects these estimates of *how* genetic or environmental something is. So if experts are still doing it, I am not sure what hope the public has!"

Experts emphasized the fact that, because of the complexity of the interaction between these factors in determining outcomes, pulling apart percentages of influence is inherently difficult. Furthermore, they claimed that viewing genes and environments as discrete influences on outcomes is unproductive, as it obscures the *interactions* of influences.

4. Assumption that the public believes physical traits are completely determined by genes
All experts described explicitly, or assumed in a more implicit way, that members of the public believe physical traits are exclusively determined by genes. According to experts, the American public assumes that genes alone determine physical outcomes, and has difficulty understanding the causes of individual behavior and other outcomes. Analysis of the expert interviews also suggests that experts assume that Americans do *not* see a role for genes in determining behavior patterns.

> "There are both environmental influences and genetic influences but the general population thinks that a lot of things are controlled by genetics … what I use when I'm introducing a topic like this is I'll say, 'Well we know that genes play a big role in controlling things like height and hair color,' things that people are very familiar with as being genetic. And I think people think of it as being really, really strongly influenced by genetics. I mean, they think that they're tall, [they] will have children that will end up being tall."

> "… there's obviously really clear impact to genetics [on height]. I mean, we think people that are tall, will have children that will end up being tall and people that are short have a high probability of having short children. So we think there's a lot to genetics. People won't normally think that there's any influence of rearing on that, but even in this situation that is really genetic, you can have an influence of environment."

5. The environment
Through the use of probes, the researcher explored the concept of "environment" that experts used in discussing genes and environments. This line of probing was in response to the fact that the "environment," as identified in past FrameWorks research, is a vague concept and, if unframed, risks activating cultural models on issues ranging widely from conservation to pollution to family.[7,8] Probing was therefore a deliberate attempt to gather data on promising ways of discussing "environments," which could be employed in reframing efforts.

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[7] Chart, H. and N. Kendall-Taylor. (2008) Reform What?: Individualist Thinking in Education: American Cultural Models on Schooling. Washington, D.C.: FrameWorks Institute.

Expert interviews revealed a relatively wide variety of conceptions of "environments." The breadth and variety of these conceptualizations points to the need to establish a concrete and specific concept of environment in communicating the science of gene-environment interaction and early child development. Despite the varying ways of conceptualizing environments, there were several common threads that ran through the expert interviews. All five experts employed, in some cases explicitly and in other cases more implicitly, a general distinction between two types of environments: "external" and "internal."

> "And so, at a cellular level we have these proteins within the cell, and those proteins have to bind to the DNA; to activate it. So there has to be a change in the *environment of the cell*, and the change in the proteins and factors within that cell that enable the DNA to actually *do* something. And so those proteins can be switched on, or increased in amount by the internal environmental context, which is influenced by other external environmental factors."

> "There are things that are internal or intrinsic to a system, and things that are external, or outside of the system. Those are really the two kinds of forces that can influence something. They are either inside or they are outside, and in fact that's how development is influenced in terms of change. There are forces within the system that are important, and then there are other forces that are outside of the system that can influence that system, and facilitate its change in certain directions."

When probed, experts tended to explain that external environments are the sum of all the things that individuals are *exposed to and experience* in the developmental process. The internal environment, on the other hand, operates *within* the individual at a cellular and genetic level. As one expert explained, there is a *place* where the chemical processes that shape outcomes take place. Giving this invisible context a concrete physical place is a promising reframing strategy. Furthermore, connecting the physical external environments that individuals live in — in which they have experiences and are exposed to various influences — to the internal environment where proteins are built, is a strategy to pursue in improving the public's understanding of genes, environments, and their interaction in shaping outcomes and differences.

Perhaps the most interesting finding regarding external and internal environments from a framing perspective is how experts used internal environment as the *link* between environments and genes. Several experts used the conception of the internal environment to clarify the concept of epigentics. Experts explained that the external environment shapes the internal cellular environments in individual bodies. The fact that the quality and characteristics of the internal environment are shaped directly by external environments and directly impact the coding of proteins, which determines how our bodies and minds work, is a powerful conceptual tool. In this way, the internal environment becomes an effective conceptual link between the external environments that we can put our hands on and shape, and the genes and DNA that are at work in our bodies. Expressed as a causal sequence: Our external environments shape the internal

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[8] FrameWorks Institute. (2009) Enough Blame to Go Around: A Focus Group Analysis of Education and Reform: A FrameWorks Research Report. Washington, D.C.: FrameWorks Institute.

environments where DNA works. DNA works differently in different internal environments. In shaping the internal environments where DNA does its work, external environments affect the expression of our genetic material.

> "The outside world can really have a profound effect on how our nerve cells communicate, because for example, there are certain toxins that we get exposed to all the time — for example, car exhaust. These [toxins] all work by interfering with the ability of those parts of the gene that control how much and where a gene is produced; the regulatory parts of the genes. That's what those toxins do — they get in and interfere with the natural process of that part of the gene. Stuff comes from car exhaust that actually gets *into* the system; it physically sticks spines to the part of the gene that controls how much of that gene will be turned on and off, and so that has a very profound effect."

III. SCIENTISTS' POLICY IMPLICATIONS

Analysis of expert interview data revealed two common messages and themes regarding the policy significance of gene-environment influences and interaction.

1. Through their power to influence genes, environments play a key role in determining developmental outcomes

When asked to explain the implications of the gene-environment interaction, all the experts we interviewed pointed to the importance of environments, emphasizing that environments shape all outcomes, even those that the public thinks are genetically determined and therefore "set in stone" like physical traits and mental abilities. Experts used the fact that all outcomes are the product of a combination of genetic *and* environmental influences to champion the importance of the environments in which children are embedded. Experts explained that, because of the pivotal role of environments, as the term was conceptualized above, policies that address low-quality developmental contexts are key in improving a wide range of developmental outcomes — from learning to physical health. Several experts also used explanations of the epigenome to emphasize the importance of environments in shaping outcomes and in accounting for individual differences. These experts argued that because, in addition to having direct effects on outcomes, environments actually influence the expression of an individual's genes, policies aiming to improve developmental outcomes in children must target and address adverse environmental conditions like pollution and the quality of out-of-home care. The influence of environments on outcomes was a powerful policy implication for our experts.

> "Where gene-environment interaction makes a difference, and why genetics and environments are so important is that the environments we experience on a daily basis have the ability to modify the developmental trajectory."

2. Realizing potential

When asked to speak to a hypothetical audience of policymakers, experts repeatedly employed the concept of *realizing individual potential*. They explained that all individuals have inherent potential, comparing this potential to the information coded in genes. According to this argument, the role of the environment is in the *realization* or *obstruction* of this potential. Experts argued that, based on what science has revealed about the fundamentally intertwined

influence of genes and environments, for individuals to take full advantage of their genes, they must be exposed to environments that provide positive developmental experiences — such as exposure to quality early education programs, high-quality foods and stable and predictable in-home environments — and limit negative exposures. The importance of environments in allowing individuals to realize potential directly counters a widely held determinist cultural model in which what is in genes is set in stone and impervious to intervention. The role that experts attributed to environments is also significant in countering the very dominant mentalist models held by Americans that characterize our work on social issues more generally, in which individual choices and internal motivation are the narrow determinants of outcomes.

CULTURAL MODELS INTERVIEWS

I. RESEARCH METHOD

To complete the other side of the comparison, we now turn to the cultural models interviews that were conducted with the public.[9] The cultural models findings presented below are based on 15 in-depth interviews with Americans in Dallas, Texas; Philadelphia, Pa; and Knoxville, Tenn. The interviews were conducted by researchers at FrameWorks during February of 2009.

In this part of our analysis, we explored the cultural models — or the shared patterns of understandings and assumptions that structure and organize thinking on an issue — that members of the general public access when they make sense of and reason about why people are the way they are and why there are differences between individuals. In doing so, we focused on the underlying patterns of assumptions and understandings that structured informant reasoning. When comparing these patterns — how people make sense of information — with the explanations and information that scientists are communicating, the mismatches between the messages being put out and the cognitive tools that people have access to use in understanding these messages become readily apparent.

Subjects
We recruited informants through a professional marketing firm, which used a screening process that FrameWorks developed and employed in past FrameWorks research. In each location, informants were selected to represent variation along the domains of ethnicity, gender, age, educational background and political ideology (as self-reported during the screening process). Previous FrameWorks research findings, as well as the cultural models literature more generally, have found education to be an important source of variation in the way people talk and think about social issues such as education and child development.[10] For this reason we were particularly sensitive to capturing variation in educational attainment in our sample.

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[10] Chart, H. and N. Kendall-Taylor. (2008) Reform What?: Individualist Thinking in Education: American Cultural Models on Schooling. Washington, D.C.: FrameWorks Institute.

Efforts were made to recruit a broad range of informants. However, the sample is not meant to be nationally representative and the demographic categories that we use to identify the quotes of interviewees in the text should not be mistaken for categorical reflections of the viewpoints of any particular groups.

Cultural models interviewing and analysis requires gathering what one cultural models researcher has referred to as a "big scoop of language."[11] A sufficient sample of talk, taken from each of our informants, reveals broad patterns of thinking, or cultural models. Recruiting a wide range of people allows us to ensure that the cultural models we identify truly represent shared patterns of thinking about a topic. And, although we are not concerned with the particular nuances in the cultural models across different groups at this level of the analyses, we recognize and take up this interest in subsequent parts of this research (as discussed in Appendix II).

Finally, we were careful to recruit a sample of civically engaged persons. We did so because cultural model interviews rely on the ability to see patterns of thinking — as evident in the analysis of patterns of *talk.* It is therefore important to recruit informants whom we have reason to believe actually *do* talk about these issues. Moreover, to ensure that participants were likely to have ready opinions about these issues without having to be overly primed, the screening procedure was designed to select informants who reported a strong interest in news and current events, and maintain an active involvement in their communities.

Interviews

Informants participated in one-on-one, semi-structured cultural models interviews lasting 1½ to 2½ hours. Consistent with the interview methods employed in psychological anthropology, cultural models interviews are designed to elicit ways of *thinking* and *talking* about issues — in this case: general ideas of what makes individuals the way they are; individual differences; and more specifically how informants think about the influence of genes and environments. As the goal of these interviews was to examine the cultural models informants use to make sense of and understand these issues, a key to this methodology is giving informants the freedom to follow topics in the directions *they* deem relevant and not in the direction the interviewer believes most germane. Therefore, the interviewer approached each interview with a set of areas to be covered, and left the order in which these topics were covered largely to the informant. Put another way, researchers were able to follow the informants' train of thought without interrupting to follow a pre-established course of questions.

We began these cultural models interviews by discussing concepts such as "why individuals are the way they are," and "why individuals are different" rather than with direct questions about specific outcomes (i.e., specific individual differences) or direct inquiries about the effects of genes and environments. This was a deliberate approach, designed to make sure that we gathered data on the models that our *informants* used to understand what influences individual outcomes and differences, rather than priming and biasing our results with the influences in which we, as researchers, were interested. Our interviews did, however, conclude with more direct questions about the roles and influences of genes and environments. These more directed questions were designed to explore the more specific cultural models that informants employed to understand

[11] Quinn, N. (2005). Finding culture in talk: A collection of methods (1st ed.). New York: Palgrave. P. 16.

these concepts and their influence on outcomes and differences (for a more detailed discussion of features of cultural models, such as their hierarchical structure, see the appendix). All interviews were recorded and transcribed. Quotes are provided in the report to illustrate major points but identifying information has been excluded to ensure informant anonymity.[12]

The strength of the cultural model interview method and the data it produces rests in its power to reveal *general patterns* of thinking (cultural models) that Americans commonly, repeatedly and implicitly employ in talking and thinking. In short, these interviews allow us to see the general patterns that implicitly structure the way Americans, broadly construed, think about a topic. Based on the common use of particular patterns of reasoning in this wide range of informants, we say these implicit patterns constitute *American cultural models*.

Analysis

Analytical techniques employed in cognitive and linguistic anthropology were adapted to make sense of the data and extract meaning for the larger task of communicating the science of gene-environment interaction. Elements of *social discourse analysis* were applied to identify shared cultural models. First, *discourses*, or common, patterned, standardized ways of talking, were identified across the sample. These discourses were then analyzed to reveal tacit organizational assumptions, relationships, logical steps, and connections that were commonly taken for granted throughout an individual's transcript and across the sample. In short, our analysis looked at patterns both in what was said (how things were related, explained, and understood) and in what was not said (assumptions). Anthropologists refer to these patterns of tacit understandings and assumptions that underlie patterns in talk as *cultural models*.

These commonly held models were pulled from each interview and categorized. The result is a refined set of overarching organizational principles that synthesizes the substance of the interviews and accounts for the data in the broadest terms possible. The models identified were modified and appropriately refined and re-categorized iteratively during each phase of the analysis to account for disconfirming or negating examples in the data.

II. THREE DOMINANT MODELS

The predominant perspective of informants was that individuals are the way they are ultimately because of the amount of will power, conviction, and determination that they posses. Other factors that influence individual outcomes and differences were assumed by all informants to be parental influences that shape individuals from early childhood, and, to a lesser degree, genes. In the following section we detail each of these three dominant assumptions.

In general, many of the models that organized informants' thinking were "nested" within three more broad, foundational and powerful cultural models: determinism, mentalist thinking and the family bubble (see the appendix for a discussion of the nested nature of cultural models).

[12] See footnote 1.

Cultural models research on outcomes, individual differences and gene-environment influence and interaction revealed the strong reliance of the public on *determinism* as a particularly powerful model in organizing thinking and reasoning on these issues. Using this model, the public assumed that differences and life outcomes are natural, static occurrences that are difficult, if not impossible, to change — a sort of "things are the way that they are" and "there is little that can be done in the way of change" perception. The determinism model hinges on a general assumption about the lack of personal agency in the face of incredible complexity and inevitable conclusions. Individuals bring this tacit perception to bear in understanding a wide range of social issues on which FrameWorks has done extensive research, from education to race, and taxes to health. In short, determinism is the pervasive cultural assumption that the world works in mysterious ways that are complex, invisible, or, as one informant said, "magic," and ultimately beyond the scope and power of individuals to control or shape. One result of the application of this model in making sense of social issues is what FrameWorks discusses as the "crisis frame" — the feeling that things are beyond remedy and control, and therefore do not warrant attention or action.[13] The specific ways that informants applied this broad cultural model in interviews are discussed in detail below.

A second powerful cultural model that has emerged in past FrameWorks research on issues ranging from race to health care is *mentalist thinking*.[14,15] According to the mentalist model, Americans tend to view outcomes and social problems as the result of individual concerns that reflect motivation and personal discipline. As such, the use of mentalist models by the public on issues related to early childhood development has a narrowing effect — it boils down complex interactions between individuals, contextual determinants and systems to either the presence or absence of individual motivation and internal fortitude — resulting in understandings of the world in which events are the exclusive product of individual drive and internal motivation. From a reform perspective, these ways of understanding outcomes and individual differences present unique challenges in engaging the public to support *systems-level* policies that address the *environments* in which individuals have experiences and which interact with genes to shape developmental outcomes.

A third overarching cultural model that flavored the patterns of assumptions informants employed in these cultural models interviews was *the family bubble model*. In this model, individuals tend to view the family and the household as the primary (if not the only) source of all expressed behavior, learning and development. As will be discussed below, an exclusive focus on parents and the home as determinants of development makes *social and public policy* implications of the science of gene-environment interaction decidedly "hard to think." This is particularly problematic for developing a coherent communications strategy because, before

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[13] FrameWorks Institute. (2009) Strategic Messaging Framing During the Economic Downturn: Remembering the Long View. Washington, D.C.: FrameWorks Institute.

[14] Chart, H. and N. Kendall-Taylor. (2008) Reform What?: Individualist Thinking in Education: American Cultural Models on Schooling. Washington, D.C.: FrameWorks Institute.

[15] Auburn, A., A. Brown and J. Grady. (2006) Fitness as a Personal Ideal: Findings from Cognitive Elicitations in Colorado and Chicago. Washington, D.C.: FrameWorks Institute.

members of the general public can be engaged around the reforms that the science suggests, communications must be designed to promote different ways to think about the contexts that shape individual outcomes and differences. A wider conception of environment — one that extends beyond parents — is required if people are to see the importance of the wide range of policies that the science of early child development suggests — policies that extend beyond simply motivating parents.

These more "meta," or broadly applied, foundational cultural models were evident across all 15 interviews. These models may appear contradictory in some respects when viewed side by side — for example leading individuals to forgo agency in the case of determinism and to over-emphasize it in the case of mentalist thinking. However, research has shown that conflicting cultural models are a common occurrence as individuals make sense of the world in which they live. Conflicting mental organizational models are a hallmark of how the mind uses a limited number of organizational models to make sense of an infinite array of information (for a more detailed discussion of cultural models see appendix).[16]

1. The "will power is the ultimate determinant of outcomes and differences" model
Informants thought about, explained, and made sense of individual outcomes and differences from the underlying assumption that *will power* is the ultimate determinant. This cultural model — that free will determines the way people are and the differences between people — was highly dominant in interview data. All informants employed the model and most used it frequently and with a high degree of automaticity. Furthermore, the will power model had a mediating function in how informants thought about the effect of genes and environments as determinants of outcomes and individual differences. Will power was imbued with the power to "override," or "trump" the effects of these two other influences.[17]

> "There's a lot of different aspects that go into it, but you've *got* to have the initiative; you've *got* to have the will power."
>
> *White Liberal Woman, Age 28, TX*

> "You have put all of it out there, the person is going to finally make their *own* decision in how they want to handle all of these different influences because even though I can sit there and say the glass is half full all day, if you want to be mad because that other part is empty, that's how you're gonna be. It's the individual. You have a lot to say about how you deal with different things."
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> *Liberal African American Woman, Age 55, TX*

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[16] Quinn, N. (2005). Finding Culture in Talk: A Collection of Methods (1st ed.). New York: Palgrave Macmillan. P. 16

[17] This will power model appears to be "nested" within the broader, more foundational, American mentalist cultural model discussed at the beginning of this section.

The essence of the will power model is that an individual is ultimately free to choose their actions, regardless of any and all other factors and forces, including genes and environments. In this way, outcomes are the result of what individuals *do* with this freedom of choice — whether or not they have the will power to take the right course of action and make hard decisions. The formative impact of will power was a powerful taken-for-granted and implicit belief, and informants relied on this model in making sense of almost every one of our questions — even when those designed to elicit material about the effects of genes or environments. Will power was not only the dominant factor in understanding individual outcomes, but was used to make sense of and explain how *other* factors, like genes and environments, affect individuals and individual differences.

> "The skills and abilities come from within, and it all starts with *you. You* have to be able to accept responsibility for yourself, and be willing to do whatever it takes to get to that particular point."
>
> *White Conservative Man, Age 36, TX*

> "You have to have to *want* to have your own personality, and want to be the leader and not a follower. And whether or not your parents taught you well and they're the saints of the community or the genes in you tell you no, *you* have to have something inside of you telling you 'No, no, no.' So if you don't have will power you're not going to do a good thing. You're not going to do the best thing. It's something that has to come within *you*. You have to *feel* it inside of you that you want to do it. Why do you feel it? Where does it come from? I don't know. Maybe it's magic. Maybe some kind of magic I don't understand. I don't know where it comes from? I don't know!"
>
> *Hispanic Liberal Woman, Age 34, PA*

> "It's like it says in the Bible. You have your own free will to do things. I mean, you can either be bad or be good. You have the ability to make your own decisions in life, but at the same time you have to live with those decisions if they turn out bad."
>
> *Conservative White Man, Age 41, TN*

The importance and role of will power was consistently the first assumption that individuals made when responding to open ended questions about what shapes the way that individuals are and their differences. In this way, the model had a high degree of *immediacy* or *automaticity* in its application in making sense of these issues. The assumption was also *sticky,* both in that once it was employed, informants tended to *stick* to it in their explanations; and in that informants frequently *defaulted* back to this understanding when they encountered difficulty or confusion in explaining outcomes and differences using other influences.

> "That's just in their DNA sometimes, but *you* in the end decide what you're gonna do with that.
>
> *Conservative White Woman, Age 28, TN*

> "Of course 'genetics' kicks that off for the obvious red hair, brown hair, tall, short, skinny, that type of thing, but there is a certain amount of *control* there that we *all* have to work on our appearance and make either the *best* us, or the *worst* us."
>
> *Conservative White Man, Age 36, TX*

The importance of and emphasis on drive was so dominant that, in many cases, this model obscured attention to other parameters that account for individual differences. It was a powerful default and clearly demonstrates how dominant models shape thinking and crowd out other considerations, perspectives and influencing factors. In the examples below, informants begin thinking of the effect of other influences, but quickly default to the *will power as the ultimate determinant* model.

> "You see, everybody's not an Olympic swimmer. Everybody's not, but there are 'special' people, you know? We just have to admit that. But I think it's how you *act* upon that. You may just have that, and just sit on it. You know, he could have very easily just sat on that talent, and done nothing, but he *chose* to *try*, and I think if you can do your best, God will help you do the rest."
>
> *African American Conservative Man, Age 54, TX*

> "Well, I'm going to tell you something. I think that especially people here in the United States have a lot of skills in them. But, you're going to tell me that a kid in Africa that does not get three meals a day, that does not sleep because he's scared that they're going to come to his little village and kill his family, that doesn't have any parents or half of his family has AIDS or any other kind of disease, they pick up a book that they can't even read because there's no light, they get up and go to school every day with the same clothes without taking a shower. Let me tell you, that's stressful. But *they* get up and go to school and are happy and smile. If you're going to come to the United States, all you need to do is *get up*. Orientals come here and they get scholarships and they get all this stuff because they *want* to do it. You guys had all these opportunities and you don't *want* to do it. The land of the free? They should change that to say 'The Land of the Lazy and the Bums.' You can *do* whatever *you* want."
>
> *Hispanic Liberal Woman, Age 34, PA*

Even when probed more specifically about the influences of genes and biology, informants still had difficulty seeing past will power and defaulted to the importance of drive and motivation in patterned and predictable ways.

> **Interviewer: You had mentioned they were both raised similarly, but if you had to pin it [difference between the informant's twin daughters] on something, what would be some reasons why they're so different from each other?**
>
> "I believe in the stars. Brandi is a typical Aquarius, she really is. Briana is a Scorpio with the attitude, the stinger, everything. Not only that, as she was growing up she didn't *want* to be in Brandi's shadow, you know? She always grew up with 'Brandi's so quiet, Brandi's so nice,' so I think that sent her the other way to being herself. So you know you

want to blaze your own trail. So I'm thinking that's a part of it; just wanting to be herself."

White Liberal Woman, Age 27, TX

2. The "parents <u>are</u> environments" model

A second dominant model that peppered all 15 interviews entailed a powerful assumption about the environments that shape individuals. Informants discussed the importance of environments, *but* held specific assumptions about *what* constituted environments. Analysis of interview data revealed the assumption that environments were almost exclusively, with a striking degree of predictability, conceptualized as *parents.* We refer to this tacit and shared assumption as the "*parents <u>are</u> environments*" model.

While dramatic in its power in shaping thought about environments, the presence and use of this dominant model is by no means surprising, given FrameWorks' ongoing research on race, health, education and early child development more generally.[18,19,20] In each of these issue areas, the influence of parents and the larger family bubble model mentioned above are powerful cultural patterns in shaping how Americans understand and make sense of the world in which they live. It is important to note that the assertion that parents *are* important parts of environments is certainly not *wrong*, and we do not mean to argue here that parents do not shape outcomes and differences. Our point is to underscore the fact that this model was so dominant that it *obscured other ways of thinking about environments* to the point that parents became the *only* environmental influence of consequence. It is the exclusionary nature of this perspective that makes it problematic in the communication of a wide range of public policies.

Parental influence was overwhelmingly the aspect of environments most readily and frequently discussed during interviews; moreover, other environmental influences that did appear in the cultural models interviews — such as mentors, coaches, teachers — were cast as extensions of the parental support system, rather than as distinct or discrete influences. The influence of school, friends, social groups — the "community" — was rarely acknowledged and, when it was, discussion was strikingly vague and shallow, and occurred only after discussions of parents had run their course and been exhausted.

Interviewer: Any other ways that you can think of that people are shaped by their environment?

"Besides their parents you mean?"

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[18] Chart, H. and N. Kendall-Taylor. (2008) Reform What?: Individualist Thinking in Education: American Cultural Models on Schooling. Washington, D.C.: FrameWorks Institute.

[19] Auburn, A., A. Brown and J. Grady. (2006) Fitness as a Personal Ideal: Findings from Cognitive Elicitations in Colorado and Chicago. Washington, D.C.: FrameWorks Institute.

[20] FrameWorks Institute. (2005) Talking Early Child Development and Exploring the Consequences of Frame Choices: A FrameWorks Message Memo. Washington, D.C.: FrameWorks Institute.

Hispanic Liberal Woman, Age 34, PA

Three models nested in "parents <u>are</u> environments":
The term "nested" is used in the literature on cultural models to explain how a number of specific models may be situated or fit into a smaller set of broader cultural models (see appendix). Within the broader *parents are environments* cultural model are three more specific models.

A. The "parents shape personality and behaviors" nested model
This nested model was used on thinking about *which* outcomes and differences are shaped by parents. While the majority of informants believed that the way parents raise their children influences a wide range of attributes, data revealed a clear pattern that this influence was *most strongly* associated with a *specific set* of outcomes and differences. Informants overwhelmingly assumed that parents were a dominant force in shaping *personality and behavior*.

> "A child is born and then I think the parents take over. They are the most responsible in guiding, and teaching that child what's right, and what's wrong, and trying to put into that child things that will matter, things that will benefit him in life."
>
> *African American Conservative Man, Age 54, TX*

> It's just like training a dog. You know how you can *train* them to be mean, you can train them to be docile, that's how people turn out. You know, just like with a son, you train them to be *tough*. You always tell them 'boys don't cry,' 'boys don't do this,' 'get up and do it again,' and if it's a girl, you're like 'oh, you've got a boo-boo.' It's 'gender' things, 'issues,' as well as 'racial' issues, as well as 'age' issues. It's just 'life.'"
>
> *White Liberal Woman, Age 27, TX*

B. *The "birth order matters" nested model*
According to the *birth order matters* model, the order in which individuals are born into a family is an important influence on behaviors.

> "I think the biggest influence [on differences between individuals] is how they adapt to their position in the family too, one being the older and one being the younger. The younger is used to being catered to and things like that."
>
> *White Conservative Woman, Age 59, TN*

> "*Birth order* has a lot to do with how people grow up and turn out. Because the *older ones* are the *responsible ones.* They have to be because you have to look after your little sister, brother, or whatever, and the youngest one usually gets to be "themselves."
>
> *African American Liberal Woman, Age 55, TX*

> "I honestly think it's [the difference between two people] because he was the older child, and she was the middle child. And he was the only boy, and she, you know, she had a younger sister, so it was kind of like, well I'm the middle child, I need to stand out in some way, and she's obviously doing that."
>
> *White Liberal Woman, Age 28, TX*

The *birth order matters* model was also a way that informants negotiated the seemingly conflicting models of *determinism* — in which there is *nothing* that individuals can do, and *mentalist thinking* — in which outcomes are *exclusively* the product of individual motivation. In this way, birth order is a preordained determinant of outcomes (determinism), but its effect is mediated by what individuals do with this circumstance (mentalist).

C. The "parenting is pivotal in early years" nested model

A third nested model was the shared assumption that there is a critical period in a child's life when "good parenting" is especially important. Informants expressed a belief that during this early period, poor parenting detrimentally affects a child for life — that parental failures during this period are intransigent, and become ingrained in individuals. In this way, early parent-child interactions were believed to instill inveterate core personality and behavioral patterns. These patterns were assumed to be resistant to change later in life. Like other models that this research uncovered, the "pivotal years" model appears to be related to the more general determinist cultural model.

> "I think early, early, early, early in life. I think when you're born, in the first few months there are certain things that you need and that's a bonding and I think that if you don't get it by the time a child starts school — if he didn't get it — there's probably not much you can do."
>
> *White Conservative Woman, Age 59, TN*

> "You really need to start working with them when they're young. Because I've seen parents say, 'I want to wait until my kids are older.' It's too late. I mean seriously, if you don't start when they're young, it's too late. When they're 10 or 12, it's too late. I've got a friend and he's got a 14-year-old daughter who is just giving him fits. And it's always been, 'Okay honey, whatever you want to do. It's okay.' Well, that's okay when they're two but when they're 14, it's too late to change it."
>
> *White Independent Man, Age 53, TN*

> "By the time a kid's three years old, he will learn a whole lot of things that will become ingrained in him forever whether it's good or bad."
>
> *White Conservative Man, Age 41, TN*

> "I think the first five or six years is the opportunity for the influences, whatever they may be, parents, family, and that will determine how you're going to be as an adult. I think after that, then you're fighting against some nature/nurture, that's there. It's very difficult to turn around."
>
> *White Conservative Man, Age 57, PA*

The presence of this model appears promising as a "slot," or opportunity to get to the importance of early experiences, and the existence of a critical development period or "window of opportunity." However, if this slot is left unfilled and unframed, our research suggests that patterns of thinking default quickly to the more general *parents <u>are</u> environments* model.

3. The "genes are set in stone" model

Informants employed a third patterned assumption in making sense of individual outcomes and differences. Informants overwhelmingly assumed that genes and the outcomes they determine *are set in stone*. Informants acknowledged that "innate," "inherent," "God-given," "inborn," "natural" or "genetic" traits are inflexible and impermeable parameters that shape the way a person is and account for differences between individuals. These intrinsic parameters — the way a person is "hardwired" — can be either positive or negative, bestowing intellectual talents and strengths, or mental and physical deficiencies.

> "I'm sure it's genetics, because I think you either have the aptitude or not. I mean, there's the opportunity for formal education and the use of that aptitude isn't guaranteed, but I think that you have to have that innate ability. So I would have to say that's genetic."
>
> *White Conservative Man, Age 57, PA*

> "There are people whose brains just simply 'work,' and they work well. I mean, yes, there are other people who are nurtured into becoming successful, but it's harder for them. Just simply because they do not have the innate God-given brain function to do things."
>
> *White Conservative Man, Age 41, TN*

A nested model: "Genes determine physical skills/deficits"

Research revealed a model nested into the broader, *genes are set in stone* model. A pervasive assumption across the sample was that the genes have an effect on a relatively narrow set of outcomes and differences. In other words, while will power and, to a lesser extent, parents were assumed to shape a wide range of outcomes, genes were believed to be responsible for determining a relatively narrow set of outcomes and differences — mainly physical traits and intelligence. Informants explained that the genetic "hand" that an individual is dealt (a metaphor employed by both lay and expert informants) determines outcomes like exceptional mental and physical skills/abilities, as well as basic physical attributes like height. This finding suggests that the assumption experts held about the public seeing physical traits as the exclusive domain of genes is fairly accurate. Some informants also saw genes playing a role in shaping a narrow set of personality traits like introversion, but none of the informants attributed any morally laden personality trait — like knowing right from wrong, compassion, kindness, or being ambitious — to genes. These types of personality characteristics were seen as being determined by will power and parental influence.

> "From what I've heard and read about him [Michael Phelps], he has a physique that is naturally suited to being a swimmer, and he really enjoys the athletic competition. I knew fellows in high school who had physiques similar to his and they liked swimming."
>
> *White Liberal Man, Age 53, PA*

> "I think that it [genius intelligence] definitely comes from genetics, and somewhere down the line there had to be somebody that was just extremely intelligent and it got passed on to him. I don't, maybe it sounds silly, but intelligence like that I feel is definitely passed on, and it's not *taught.* Either you have it, or you don't."
>
> *White Conservative Woman, Age 28, TN*

> "I think that all pretty much has to do with genetics because my dad is very quiet, doesn't talk a whole lot. You have to talk to him to be able to get him *to* talk to you. My mom, partier, life of the party, loved going out, and will talk to anyone, doesn't matter. I'm the same way as my mom. Now my sister, shy, won't talk to anyone, you have to talk to her, you have to pull things out of her just like you had to do with my dad. So my sister got more of my dad's personality, and I got more of my mom's personality."
>
> *White Liberal Man, Age 25, TN*

III. SHALLOW REASONING ABOUT *INTERACTIONS* AND A FOURTH DOMINANT MODEL

The three dominant models presented above were employed by all informants throughout the interviews. This represents, in FrameWorks' experience across multiple issues, a high degree of consensus on a particular issue. Another pervasive trend was the difficulty that informants had in thinking about how will power, parents and genes might *interact* to determine outcomes. In response to questions, informants shifted back and forth between the models, sometimes in inconsistent or even contradictory ways. This lack of awareness of the specific causal mechanisms that underlie the interaction of causal forces left respondents unable to talk and reason about these dynamics except at the most general levels. Some informants stated that one model "mixes" with another, but even these informants could not discuss or describe this process in any greater detail, despite being repeatedly encouraged and probed to do so. When asked to provide more detail about exactly *how* causal factors interact with one another to determine outcomes and differences, informants ran into considerable difficulty and that suggests an inability to reason about interaction.

> *"Attitude,* I think can be shaped by the environment. Attitude, but then again, that can be shaped by genes, too. [Chuckle] So, it's kind of a hard, and tricky question."
>
> *African American Conservative Man, Age 54, TX*

> "Well, I mean, I guess — I don't know enough about DNA and all that. I don't know enough about all that DNA and all that, and I mean, I guess it can probably skip generations, or you know?"
>
> *White Conservative Woman, Age 59, TX*

> "I can't account for what makes these two identical twins completely different, even though they're physically identical. I can't say … it must be society that makes one identical twin different from the other identical twin."
>
> *White Liberal Man, Age 53, PA*

Otherwise articulate informants ran into difficulties when asked to explain how genes and environments interact in the context of specific scenarios/situations designed to get them thinking and talking about environmental and genetic influences on outcomes. The problems that many respondents had providing complete or even coherent answers to these examples can be seen to stem from their limited knowledge/understanding of the actual dynamics involved. Many respondents, who had been previously verbose, became inarticulate and short when probed for more details, clearly finding it difficult to move beyond vague generalities on this issue.

> "I think that's … I think that's a genetic thing. Now, I don't know why it wouldn't be. You know something about that I don't?"
>
> *White Independent Man, Age 53, TN*

> "I guess, I mean the 'genes' part is already there is, but then, you're put into a situation where you've either got to manipulate it a little bit … or you know?"
>
> *White Liberal Woman, Age 28, TX*

Other respondents made the attempt to address the hypothetical scenarios/situations more directly, but with only limited success. In attempting to describe the causal dynamics in greater detail, they often lost their train of thought and were unable to reach a coherent conclusion.

> "Well, it could be a genetic allergy, but I also think sometimes our environment causes us allergies to things that the more things we're exposed to, you know, you keep everything too sanitary and too … I think you can develop allergies because your body wasn't allowed to develop something that it needed to … to be exposed to. Um … and they're saying that now about being too clean. You know, kids used to eat dirt and we survived that! You know what I'm saying? So um … and … well"
>
> *White Conservative Woman, Age 59, TN*

> "So, I think they're mutually exclusive, so you're born with something, you're predisposed to having a problem with that. On the other side, something that doesn't exist, doesn't deliberately take action on you, but whenever those — whenever *genetics* and the *environment* come together, and genetics, which created a — a being to be able to *act,* ended up *doing it to itself*, so um … [LONG PAUSE — 12 SECONDS] … [Chuckle] I-I-I think that has more to do with *genetics,* so …"
>
> *White Conservative Man, Age 36, TX*

The "percentages of influence" model

In wrestling with how the disparate influences of will power, parents and genes could come together to shape outcomes, informants employed a fourth dominant cultural model — relying on an assumption that *different* factors exert *separate* influences in determining outcomes. We refer to this as the *percentage of influence* model to reflect both frequent informant references to "percentages," and to capture the fact that they assumed *discrete* and *unrelated* effects and influences, rather than *interactions* between factors. In this model, outcomes were the *aggregate of discrete factors* rather than their comingling. This patterned understanding of the relationship between influences was implicitly employed within individual interviews and across the sample.

> "I think genes would be like 55% of the way you are. So you could have it in you telling you 'this is what you're going to do.'… But of course, it [motivation/will power] is going to pull me and it's stronger than however I was raised, whatever I saw on TV. My parents could be the smartest people and the richest people in the world but I'm going to do what I want to do."
>
> *Hispanic Liberal Woman, Age 34, PA*

> "I feel like I've gathered both of my parents' personalities. My dad has a temper, and a very short fuse, and I tend to be like that. He tries to control the situation. I tend to do the same thing. But then again, it's all in how you were brought up, too. It's not just DNA. I think it's both working about 50-50.
>
> *White Conservative Woman, Age 28, TN*

IV. BROAD IMPLICATIONS OF THE DOMINANT MODELS

1. The dominance of the will power model presents two communications implications.
    a. As will power is quite simply beyond the scope of the science of gene-environment interaction and individual differences, attempts to translate expert understandings of these concepts are unlikely to deal with states of motivation. However, the research presented here suggests that translations of this science that do not deal with the dominant will power assumption are likely to be met with considerable suspicion, resistance and skepticism. Translational efforts in this area of early child development must, therefore, be aware of the existence of a strong cultural model that leads people to see a force that supersedes and overrides the influence of genes and environments.
    b. Because the will power model is clearly nested in a more general mentalist cultural model, the public's understanding of genes and environments is likely to be laced with the same communication traps and barriers associated with mentalist models — namely a cognitive blindness to the importance of *contexts* in influencing outcomes and *systemic* solutions to social problems. The science of gene-environment interaction points clearly to the importance of environments in shaping all outcomes. FrameWorks' research has shown that a focus on will power and motivation is powerful in *obscuring the ability to realize the importance of environments and the role of public policy in shaping these contexts of influence*.[21] If *all* that is needed to improve *all* outcomes is more will power, environments and the policies that shape them have little chance of making it onto the public's radar.
2. Results indicate that Americans can appreciate the effect of environments and realize that genes are not solely responsible for *all* outcomes — that determinism is not the whole story. However, the overwhelming focus on *parents as environments* presents a communications challenge because of the differences between this lay understanding of context and the scientific conception of environments. The assumption that parents *are* environments narrowly limits the scope of policies that the public will deem relevant to those that affect parents and parenting. With a wider conception of environments as the entirety of experiences and exposures (in line with the expert concept), a wider range of policies becomes relevant in thinking about developmental outcomes and individual differences. In short, the focus on parents as environments points to the need to broaden the public's implicit assumptions about developmental environments and open up the

[21] Bales, S.N., (2008) Framing Community Health as if Food and Fitness Mattered: A FrameWorks Message Memo. Washington, DC: FrameWorks Institute.

understanding that a wide range of contextual factors influence and impact child development.

3. The parents as environments model also creates a clear path of *responsibility*. If *parents* are all that people see when they hear about *environments*, parents become narrowly responsible for shaping outcomes. This focus obscures other, more social, conceptions of responsibility — the fact that citizens and society more generally play a role in shaping contexts and experiences through the policies that they support.
4. The nested *parenting is pivotal in early years* model is more promising as an access point in communicating the importance of early experiences. This model, consistent in some respects with what scientists refer to as "windows of opportunity," may offer a way of transitioning to and engaging in the core story of early child development and the idea that brain architecture is being built in early childhood. If the contextual scope can be widened from the narrow focus on parents, this transition may allow communications to speak to the importance of the early experiences more broadly and create powerful policy messages.
5. The cultural models that informants applied to understanding genes are highly significant in FrameWorks' science translation task. Understanding the effect of genes and the outcomes they shape as being set in stone threatens to crowd out the fact that genes *can* be affected — that these effects are *not* set in stone. When genes and their corresponding outcomes become impermeable, there is little chance of affecting these outcomes through intervention, and policies as solutions become hard to think and support. The impermeable nature of genes in this model is interesting in light of the expert story, which emphasizes the *interaction* and *permeability* between genes and environments and the role of environments in shaping all outcomes. In effect, the set-in-stone model limits the outcomes that scientists and reformers can talk to the public about and crowds out the influence of environments, making the concept of gene-environment *interaction* difficult to translate.
6. FrameWorks' reframing research has shown again and again that when *solutions* to a problem are apparent and logically aligned with the conceptualization of a problem, support for and engagement in policies and a sense of public responsibility for social problems increases. On the other hand, dire problems without solutions foster a sense of futility, compromise agency and discourage engagement.[22] If the outcomes determined by genes are set in stone, there are, in effect, no available solutions to problems that occur in the domain of outcomes that people connect to genes (physical traits and skills, intelligence, and specific aspects of personality and social skills). The presence and use of the *genes are set in stone* model therefore shifts attention away from solutions and fosters a sense of the intransigence of problems and the futility of engagement and intervention.

[22] FrameWorks Institute's research has consistently demonstrated that when confronted with crisis stories about social problems — from poverty, to health care to global warming — Americans interpret social problems to be insurmountable and unsolvable. They may feel sympathy for those affected by the crisis, but broad solutions that might transform the issue are very hard to imagine. Crisis frames do not encourage pragmatic thinking about the repair and renovation of systems and structures.

7. The fact that different models were applied to different outcomes is a major finding that has communication implications. Informants accessed different models to understand and explain different outcomes and differences. For example, they used the model of *genes are set in stone* to understand intelligence, but a model of *parents <u>are</u> environments* to understand personality and behavior. This suggests an interesting cognitive compartmentalization but presents a challenge in discussing outcomes as the *integration* of influences. Successful communications must recognize and address the various ways that Americans think about different aspects of the way people are and ways in which they are different. This observation is, of course, offered with the exception of free will, which was seen as an equally strong influence over all outcomes.
8. The *percentage of influence* model further contributes to the difficulty of talking about *interaction* between the influences people implicitly perceive as inherently *separate* and *discrete*. The *percentage of influence* model must be addressed in translational communications by shifting patterns of thinking away from the assumption that genes and environments have separate influences on outcomes, and towards a concept that gets environments into genes and clarifies the *process of interaction* between these influences. Addressing this translation challenge through the use of a simplifying model is particularly promising. The following quote illustrates the opportunity of connecting genes to environments through a simplifying model.

> "You can have all this innate *intelligence*, and for lack of a better term, 'not use it,' and it will just sit there — it will just sit there like a light switch that's off. You have to have something in there that turns the light switch on and says, okay, let's go to work."
>
> *Conservative White Man, Age 41, TN*

V. RECESSIVE MODELS

Several other models emerged from the interviews. Although these "recessive models" were not as sticky, frequently employed, or automatic as the dominant models discussed above, they are nonetheless important and represent promising reframing directions. If communications can shift away from the dead-end dominant patterns described above and towards the models described below, the public will be better situated to interpret, understand and, most importantly, to use the science to inform opinions and positions.

We call the three patterns described below "recessive" models, and most emerged in the context of discussions dealing more specifically with how genes and environments shape outcomes and differences. These recessive models can be thought of as ways that are *available* to the public to think about the influence of genes and environments but which are not *readily* or *automatically* employed in understanding these topics. Put another way, these recessive models require specific cuing to become active in the mind. We plan to pursue these recessive models as possibly promising avenues of thinking because they appear to help informants envision a more nuanced interactive relationship between genes and environments as influences on developmental outcomes and in thinking about individual differences.

1. The "environments modify genetic predispositions" model
Less than a quarter of informants occasionally employed this model for understanding how genes and environments relate in influencing outcomes and differences. This model failed to generate in-depth discussions and detailed explanations. When it did appear, the informants who used the *environments modify genes* model talked about the relationship between genes and parents in a more integrated way, as opposed to merely juxtaposing them, as was the case in the more dominant *percentages of influence* model described above. Rather then switching between models in their explanations of outcomes or attributing individual differences to the aggregate of influences, the excerpts below reveal a different model, in which environmental factors *modify* (e.g., nourishing/enhancing or suppressing/diminishing) genetic predispositions.

> "Let's see; we could have genes, but my allergies bother me, and this other person could not have the allergy issue, but because of the amounts of cedar — because that's what's killing me now you know? It may affect the other person differently, you know?"
>
> *White Liberal Woman, Age 27, TX*

> "It's not just genetics…it's *exposure*."
>
> *African American Liberal Woman, Age 55, TX*

> "I think that you may be predisposed to certain emotions or whatever but the environment can help you either overcome that or lessen the impact of it one way or the other."
>
> *White Independent Man, Age 53, TN*

> "That's '*exposure.'* You know '*genetics*' and '*exposure.*' *Life experiences*, *exposure*, it *all goes together*."
>
> *African American Liberal Woman, Age 55, TX*

If communications research can locate the specific frame elements, or triggers, that activate the *environments modify genetic predispositions* model, the public will be better positioned to interpret and use the science of gene-environment interaction in thinking about issues of child development, early education and child welfare.

2. The "drive is located in the brain" model
When probed about where will power comes from, several informants' explanations revealed a tacit assumption that this motivation and drive is physiologically based, "in the brain."

> "It has to be something inside of you. It has to be something in your brain. Like each part of your brain has to help you smell, to help you think, to help you move your arms, and there has to be a part there to help your self-esteem to help give you that power or energy to say 'I can do this,' to give you that strength. And some people may be weak in that

> part of the brain. It's amazing how you could hurt somebody's life by just touching their brain, a spot in their brain. You open it and you just touch it."
>
> *Hispanic Liberal Woman, Age 34, PA*

Rooting will power and grounding motivation firmly in the physical brain is a promising reframing strategy. If the discrete and mystical element of will power can be *concretized* and given a *physical* location, it can be brought into the message of gene-environment interaction. If communications can first bring a broad concept of environments *into* an interaction with genes, and will power can be rooted in physiology, environments can be framed as having an influence on will power. It will be essential, however, to give careful attention to reframing will power to shift way from the pervasive, stubborn and sticky patterns of mentalist thinking discussed above. Our ongoing research on executive function will be directly relevant to this task in revealing strategies for how best to communicate about motivation through *skills* like decision-making and reasoning.

3. The "popular culture as a determinant" model

The influence of popular culture, especially television and videogames, was used by some informants to account for a narrow range of behaviors: those that were considered highly extreme, unusual and that informants could not be adequately explain through any of the three more dominant models. In the popular culture model, an individual is an essentially passive actor, whose thoughts, feelings, and attitudes are shaped by external media influences.

> "TV's a *huge* one. A lot of people sit there without thinking these days and they just mindlessly take that in, and it becomes programmed into their brain."
>
> *White Conservative Man, Age 36, TX*

> "He [someone who donated to charity] probably saw it on television. I mean, some kids don't have a place to live. There will be some kids out here tonight when it's 20 degrees … and snowing, and he probably realized hey, my mom and dad treat me pretty good."
>
> *White Liberal Woman, Age 35, TN*

> "I don't think a 6-year-old kid would just do that without some *influence*, you know? Maybe it was something at church, or another organization. Or maybe he saw something on TV."
>
> *White Conservative Woman, Age 59, TX*

This model was most frequently used to explain exceptionally violent acts. Informants who employed this recessive model assumed that choices and behaviors are shaped by powerful media forces that in some cases could even trump the influence of will power.

As further evidence of the recessive nature of this model, when extreme behavior was attributed to popular culture, informants went to great lengths to explain why this was the case, rather than simply taking this explanation for granted. In other words, informants felt the need to explain *why* and *how* media influence behavior whereas, with the more dominant models of parental influence or will power, they felt no such need. This feature of the popular cultural model is evidenced by those instances in which the model was either expressed in a defensive manner, or was counterbalanced in favor of the *parents are environments* model.

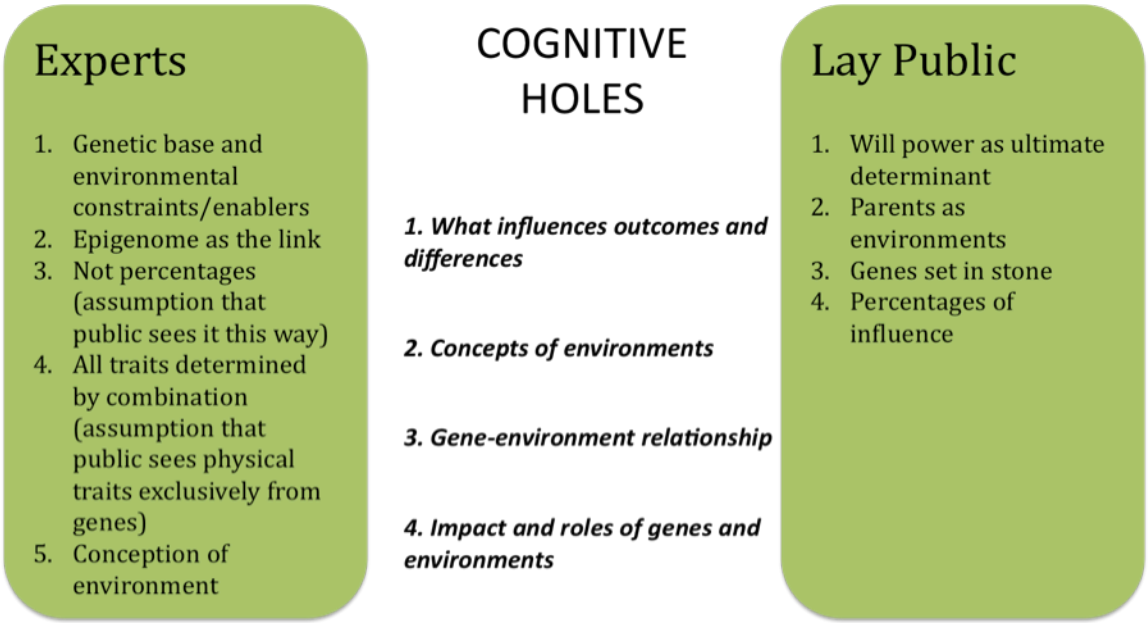
> "I think he [one of the Columbine kids] spent a ton of time on videogames, which I'm not against videogames. I hunt, okay? I kill animals. So, it's not, you know, I don't have an issue with it, but I have an issue with the games because there's no consequence if you kill somebody."
>
> *White Independent Man, Age 53, TN*

> "So, I think stuff like that [violent behavior] comes from videogames, and some of this junk that they are saying on TV, and hearing the music that they listen to."
>
> *White Conservative Man, Age 36, TX*

> "Like I saw a show the other day talking about 'Oh, I feel like killing my mom. Can you guys help me kill my mom?' 'Why?' 'Oh, she punished me. She took my allowance. She doesn't let me go to this party.' So now kids that weren't ever thinking 'I can actually kill my mother,' now they're thinking about it."
>
> *Hispanic Liberal Woman, Age 34, PA*

While not as promising as the first two recessive models, the *poplar culture as a determinant* model is positive in one respect. In acknowledging the effect of the media — a *systems-level* influence — on individual outcomes and differences, this model may position the public to appreciate a role for public policy in shaping outcomes and differences (the role of public policy in affecting media is relatively "easy to think" as the public has a lot of practice making this connection). Once the importance of policy in affecting systems-level factors has been "planted," the effect of other systems-level influences may be more readily apparent — like early education programming and funding for community development.

COGNITIVE HOLES



An integral part of our analysis is to identify particular areas where "cognitive holes" impair a productive understanding of the science. Cognitive holes are gaps that exist between how experts explain and talk about a concept and how average Americans conceptualize the same issue. By comparing the data gathered from experts with those collected from members of the general public, "cognitive holes" become powerfully and readily apparent. Filling holes improves the uptake and ability to use expert information in normal cognitive processes such as reasoning and decision making. The figure above represents the "*map"* of expert explanations, lay cultural models, and the gaps that exist between these two groups.

An integral part of FrameWorks' Strategic Frame Analysis™ is to first generate this map and then design simplifying models that fill these holes by cultivating clarifying metaphors that concretize key scientific concepts. Designing simplifying models relies on knowing the *locations* and *characteristics* of expert-public cognitive holes — it requires a detailed and in-depth understanding of the map.

1. *Influences on outcomes and differences*
   One glaring gap between expert and lay informants was in respect to *the factors that shape individual outcomes and differences*. This gap stems from the dominant will power cultural model and the perceived importance of motivation in determining an incredibly wide range of outcomes — from personality and behavior, to skills and abilities, to physical appearance. For lay informants, will power had the ability to override and moderate the effects of genes and environments. The expert account contained no discussion of individual will power or motivation.

2. *Conceptions of environments*
   A second conspicuous cognitive hole in this domain emerged from comparing data on conceptions of "environments." Data from cultural models interviews point clearly to a restricted lay conception of environments. The expert concept of environments is dramatically more broad and inclusive.

3. *Gene-environment relationship*
   Cultural models interviews revealed an underlying assumption that genes and environments have discrete and separate influences on outcomes. On the other hand, the most pervasive theme from expert interviews was that outcomes and differences are shaped by the *interaction between genes and environments*.

4. *The impact of genes*
   Cultural models interviews revealed a heavily deterministic understanding of genes — in which genes and the outcomes they determine are firmly set in stone. The expert explanations are in opposition to this understanding — resting on the idea that genes and outcomes are *not* set in stone. Rather, experts explained that environments have a fundamental impact on how and when genetic material is expressed.

CONCLUSIONS

This report describes and examines the implications of ways members of the scientific community and the general public think about individual outcomes, differences, genes and environments. Thinking on these topics is examined through the analysis of interview data with members of both of these groups. The report considers the limitations of the dominant cultural models currently in place in the public's thinking about individual outcomes and characteristics, differences between individuals, and the influences of genes and environments. The report also locates specific gaps, or cognitive holes, between the ways experts and the general public understand and talk about these issues. These lay-expert gaps must be addressed in communicating and translating the science of gene-environment influence and interaction.

Ultimately, the report demonstrates the pressing need for scientists and reformers to work on providing Americans with alternative ways of thinking about what determines individual outcomes, differences between individuals and more specifically about how genes and environments interact and influence developmental outcomes. New communications strategies are required to shift away from patterns of thinking in which will power is the ultimate determinant of outcomes and differences, in which environments of influence are comprised exclusively and narrowly of parents, in which genes are set in stone, and in which environments and genes occupy discrete spheres of influence. Communications must focus on the interaction between genes and environments to open up a wider range of contextual factors, creating a powerful message about the importance of policies that shape the contexts that science has demonstrated are of developmental significance. Subsequent phases of research will explore precisely how scientists can most successfully address the challenges presented here.

While this research represents the first phase of our larger investigation, several preliminary recommendations and future directions have become apparent:

1. Expand the environments that people see as significant in influencing outcomes and differences, possibly through a concept of environments as the set of all an individual's interactions, relationships and experiences.
2. Get environments *into* genes through a simplifying model of the epigenome.
3. Reframe will power as decision-making or reasoning (employing results of FrameWorks' parallel research inquiry on executive function) and connect these skills to the core story by grounding them in brain architecture.

APPENDICES

APPENDIX I: METHODOLOGICAL APPROACH TO "MAPPING THE GAPS"

Mapping expert knowledge against the cultural models used by the public to process information on social problems is an approach based on the analytic principles and data-gathering methods adapted over the last 15 years from within the fields of cognitive anthropology and cognitive linguistics. At FrameWorks, we use this methodology to inform the work of advocates interested in raising the salience of, and public support for, public-policy solutions to social problems. In subsequent phases of this research, FrameWorks will continue to examine how the gaps between the science "story" of gene-environment interaction and the cultural patterns applied by the public (identified in this report) affect advocate efforts to gain support for policies that address early childhood development and well-being. FrameWorks' past research on child development more generally suggests that scientific concepts of child development and gene-environment influences/interactions are not well understood or easy to convey to lay audiences.[23] However, FrameWorks' research has also shown that the use of strategically employed reframes and simplifying models in translating this science greatly improves the extent to which the public expresses support for policy reforms in areas that matter greatly for children.[24]

First, we explored and synthesized *scientific discourse* on the influence of genes and environments, the interactions between these factors, and their role in understanding individual differences more generally. In a series of "expert interviews," we examined both the substance of what scientists were discussing as well as patterns in scientists' written and oral explanations of these concepts. More explicitly, we focused on both the foundational themes and concepts in the science, and on the useful metaphors and analogies employed by scientists when they communicate these abstract concepts to lay or policy-related audiences.

The second phase of this inquiry involved assessing the extent to which lay audiences understand the same concepts: the influences of genes and environments, their interaction and the causes and explanations for individual differences. In this part of our analysis, we specifically explored the cultural models that members of the general public access when they think about the reasons people are the way they are and why there are differences between individuals. As such, in a series of cultural models interviews we conducted with the public, we were interested in uncovering *how* Americans understand these general concepts, as well as the various ways that these understandings affect their assessments of a wide range of outcomes, ranging from things like skills, abilities and individual achievement to physical traits, personality and individual success. In doing so, we focused on the *underlying patterns* that structured how informants expressed their understanding of these concepts in talk.

Rather than directly asking about the effects of genes and environments, we began these cultural models interviews using an open-ended approach, discussing concepts such as "why individuals

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[23] FrameWorks Institute. (2005) Talking Early Child Development and Exploring the Consequences of Frame Choices: A FrameWorks Message Memo. Washington, D.C.: FrameWorks Institute.

[24] See footnote 1.

are the way they are," and "why individuals are different." This ensured that we were accessing the models that our *informants* used to understand these influences and interactions rather than priming or biasing the interviews with the specific influences in which we were interested. This open-ended approach revealed that *average Americans have models for understanding individual differences that do not rely solely or even primarily on genes and environments, let alone the interaction between these influences*. This is a major finding of our research and has implications for communicating the science of gene-environment interaction and individual differences more generally. In addition to the open-ended approach, our interviews concluded with more direct questions about the influences of and interactions between genes and environments. This allowed us to explore the more specific cultural models that informants employed to understand these concepts and their influence on specific outcomes of interest (for a more detailed discussion of some key features of cultural models, such as their hierarchical "nested" structure, see the appendix attached here).

In the third and final phase of this inquiry we compared the two sets of interviews. In this analysis we "mapped" or explained the differences between the ideas and principles that the experts discussed against patterns of public understanding. As a part of this process, we were especially interested in identifying particularly crucial gaps between expert explanations and public assumptions, identifying places that, if filled with clarifying information or more recessive patterns of understanding, would greatly improve understanding of how genes and environments interact to shape individual outcomes and differences. We also tried to identify a range of initial reframing strategies, taken from the science of communication, which might be applied to bridge the gap between scientific knowledge and public perception on this issue.

APPENDIX II: THEORETICAL FOUNDATIONS

The following are well-accepted characteristics of cognition and features of cultural models that figure prominently into the results presented in this report and in FrameWorks' research more generally.

1. Top-down nature of cognition

Individuals rely on a relatively small set of broad, *general* cultural models to organize and make sense of information about an incredibly wide range of *specific* issues and information. Put another way, members of a cultural group share a set of common general models that form the lens through which they think and make sense of information pertaining to many different issues. This feature of cognition explains why FrameWorks' research has revealed many of the same cultural models being used to think about seemingly unconnected and unrelated issues — from education to health to child development. For example, Frameworks research has found that people use the *mentalist* model to think about child development and food and fitness — seemingly unrelated issue areas. For this reason, we say that cognition is a "top-down" phenomenon. *Specific* information gets fitted into *general* categories that people share and carry around with them in their heads.

2. Cultural models come in many flavors but the basic ingredients are the same

At FrameWorks, we often get asked about the extent to which the cultural models that we identify in our research and that we use as the basis of our general approach to social messaging apply to ALL cultures. That is, people want to know how inclusive our cultural models are and

to what extent we see/look for/find differences across race, class or other cultural categories. Because our aim is to create messaging for mass media communications, we seek out messages that resonate with the public more generally and, as such, seek to identify cultural models that are most broadly shared across society. We ensure the models are sufficiently broad by recruiting diverse groups of informants in our research who help us to confirm that the models we identify operate broadly across a wide range of groups. Recruiting diverse samples in our cultural models interviews often confuses people who then think we are interested in uncovering the nuanced ways in which the models take shape and get communicated across those groups, or that we are interested in identifying different models that different groups use. To the contrary, our aim is to locate the models at the broadest possible levels (i.e., those most commonly shared across *all* cultural groups) and to develop reframes and simplifying models that advance those models that catalyze systems-level thinking. The latter does not negate the fact that members of different cultural groups may respond more or less enthusiastically to the reframes, and this is one of the reasons why we subject the reframes that we recommend to our clients to rigorous experimental testing using randomized controls that more fully evaluate their mass appeal.

3. Dominant and recessive models

Some of the models that individuals use to understand the world around us are what we call "dominant" while others are more "recessive," or latent in shaping how we process information. Dominant models are those that are very "easy to think." They are activated and used with a high degree of immediacy and are persistent or "sticky" in their power to shape thinking and understanding — once a dominant model has been activated it is difficult to shift to or employ another model to think about the issue. Because these models are used so readily to understand information, and because of their cognitive stickiness, they actually become easier to "think" each time they are activated — similar to how well-worn and familiar paths through fields are when walking through a forest and in so doing these paths become even more well-worn and familiar. There is therefore the tendency for dominant models to become increasingly dominant unless information is reframed to cue other cognitively available models (or, to continue the analogy here, other walking paths). Recessive models, on the other hand, are not characterized by the same immediacy or persistence. They lie further below the surface, and while they *can* be employed in making sense of a concept or processing information about an issue — they *are* present — their application requires specific cues or primes.

Mapping recessive models is an important part of the Frameworks approach to communication science and a key step in reframing an issue. It is often these recessive patterns of thinking that hold the most promise in shifting thinking away from the existing dominant models that often inhibit a broader understanding of the role of policy and the *social* aspect of issues and problems. Because of the promise of these recessive models in shifting perception and patterns of thinking, we discuss them in this report and will bring these findings into the subsequent phases of FrameWorks' iterative methodology. During focus group research, in particular, we explore in greater detail, *how* these recessive models can most effectively be cued or "primed" as well as how these recessive models *interact* with and are *negotiated* vis-à-vis emergent dominant models.

4. The "nestedness" of cultural models

Within the broad foundational models that people use in "thinking" about a wide variety of issues lay models that, while still general, broad and shared, are *relatively* more issue-specific. We refer to these more issue-specific models as "nested." For example, when informants thought about basic skills, they employed a model for understanding where these skills come from, but research revealed that this more specific model was nested into the more general *mentalist* cultural model that informants implicitly applied in thinking this issue. Nested models often compete in guiding or shaping the way we think about issues. Information may have very different effects if it is "thought" through one or another nested model. Therefore, knowing about which models are nested into which broader models helps us in reframing an issue.

***About FrameWorks Institute*:** The FrameWorks Institute is an independent nonprofit organization founded in 1999 to advance science-based communications research and practice. The Institute conducts original, multi-method research to identify the communications strategies that will advance public understanding of social problems and improve public support for remedial policies. The Institute's work also includes teaching the nonprofit sector how to apply these science-based communications strategies in their work for social change. The Institute publishes its research and recommendations, as well as toolkits and other products for the nonprofit sector, at www.frameworksinstitute.org.

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