

The Early Catastrophe: The 30 Million Word Gap by Age 3

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During the 1960's War on Poverty, we were among the many researchers, psychologists, and educators who brought our knowledge of child development to the front line in an optimistic effort to intervene early to forestall the terrible effects that poverty was having on some children's academic growth. We were also among the many who saw that our results, however promising at the start, washed out fairly early and fairly completely as children aged.

In one planned intervention in Kansas City, Kans., we used our experience with clinical language intervention to design a half-day program for the Turner House Preschool, located in the impoverished Juniper Gardens area of the city. Most interventions of the time used a variety of methods and then measured results with IQ tests, but ours focused on building the everyday language the children were using, then evaluating the growth of that language. In addition, our study included not just poor children from Turner House, but also a group of University of Kansas professors' children against whom we could measure the Turner House children's progress.

All the children in the program eagerly engaged with the wide variety of new materials and language-intensive activities introduced in the preschool. The spontaneous speech data we collected showed a spurt of new vocabulary words added to the dictionaries of all the children and an abrupt acceleration in their cumulative vocabulary growth curves. But just as in other early intervention programs, the increases were temporary.

We found we could easily increase the size of the children's vocabularies by teaching them new words. But we could not accelerate the rate of vocabulary growth so that it would continue beyond direct teaching; we could not change the developmental trajectory. However many new words we taught the children in the preschool, it was clear that a year later, when the children were in kindergarten, the effects of the boost in vocabulary resources would have washed out. The children's developmental trajectories of vocabulary growth would continue to point to vocabulary sizes in the future that were increasingly discrepant from those of the professors' children. We saw increasing disparity between the extremes--the fast vocabulary growth of the professors' children and the slow vocabulary growth of the Turner House children. The gap seemed to foreshadow the findings from other studies that in high school many children from families in poverty lack the vocabulary used in advanced textbooks.

Rather than concede to the unmalleable forces of heredity, we decided that we would undertake research that would allow us to understand the disparate developmental trajectories we saw. We realized that if we were to understand how and when differences in developmental trajectories began, we needed to see what was happening to children at home at the very beginning of their vocabulary growth.

We undertook 2 1/2 years of observing 42 families for an hour each month to learn about what typically went on in homes with 1- and 2-year-old children learning to talk. The data showed us that ordinary families differ immensely in the amount of experience with language and interaction they regularly provide their children and that differences in children's experience are

strongly linked to children's language accomplishments at age 3. Our goal in the longitudinal study was to discover what was happening in children's early experience that could account for the intractable difference in rates of vocabulary growth we saw among 4-year-olds.

Methodology

Our ambition was to record "everything" that went on in children's homes—everything that was done by the children, to them, and around them. Because we were committed to undertaking the labor involved in observing, tape recording, and transcribing, and because we did not know exactly which aspects of children's cumulative experience were contributing to establishing rates of vocabulary growth, the more information we could get each time we were in the home the more we could potentially learn.

We decided to start when the children were 7-9 months old so we would have time for the families to adapt to observation before the children actually began talking. We followed the children until they turned three years old.

The first families we recruited to participate in the study came from personal contacts: friends who had babies and families who had had children in the Turner House Preschool. We then used birth announcements to send descriptions of the study to families with children of the desired age. In recruiting from birth announcements, we had two priorities. The first priority was to obtain a range in demographics, and the second was stability--we needed families likely to remain in the longitudinal study for several years. Recruiting from birth announcements allowed us to preselect families. We looked up each potential family in the city directory and listed those with such signs of permanence as owning their home and having a telephone. We listed families by sex of child and address because demographic status could be reliably associated with area of residence in this city at that time. Then we sent recruiting letters selectively in order to maintain the gender balance and the representation of socioeconomic strata.

Our final sample consisted of 42 families who remained in the study from beginning to end. From each of these families, we have almost 2 1/2 years or more of sequential monthly hour-long observations. On the basis of occupation, 13 of the families were upper socioeconomic status (SES), 10 were middle SES, 13 were lower SES, and six were on welfare. There were African-American families in each SES category, in numbers roughly reflecting local job allocations. One African-American family was upper SES, three were middle, seven were lower, and six families were on welfare. Of the 42 children, 17 were African American and 23 were girls. Eleven children were the first born to the family, 18 were second children, and 13 were third or later-born children.

What We Found

Before children can take charge of their own experience and begin to spend time with peers in social groups outside the home, almost everything they learn comes from their families, to whom society has assigned the task of socializing children. We were not surprised to see the 42 children turn out to be like their parents; we had not fully realized, however, the implications of those similarities for the children's futures.

We observed the 42 children grow more like their parents in stature and activity levels, in vocabulary resources, and in language and interaction styles. Despite the considerable range in vocabulary size among the children, 86 percent to 98 percent of the words recorded in each child's vocabulary consisted of words also recorded in their parents' vocabularies. By the age of 34-36 months, the children were also talking and using numbers of different words very similar to the averages of their parents (see the table below).

Families' Language and Use Differ Across Income Groups

Measures & Scores	Families					
	13 Professional		23 Working-class		6 Welfare	
	Parent	Child	Parent	Child	Parent	Child
Protest score ^a	41		31		14	
Recorded vocabulary size	2,176	1,116	1,498	749	974	525
Average utterances per hour ^b	487	310	301	223	176	168
Average different words per hour	382	297	251	216	167	149

^a When we began the longitudinal study, we asked the parents to complete a vocabulary pretest. At the first observation each parent was asked to complete a form abstracted from the Peabody Picture Vocabulary Test (PPVT). We gave each parent a list of 46 vocabulary words and a series of pictures (four options per vocabulary word) and asked the parent to write beside each word the number of the picture that corresponded to the written word. Parent performance on the test was highly correlated with years of education ($r = .57$).

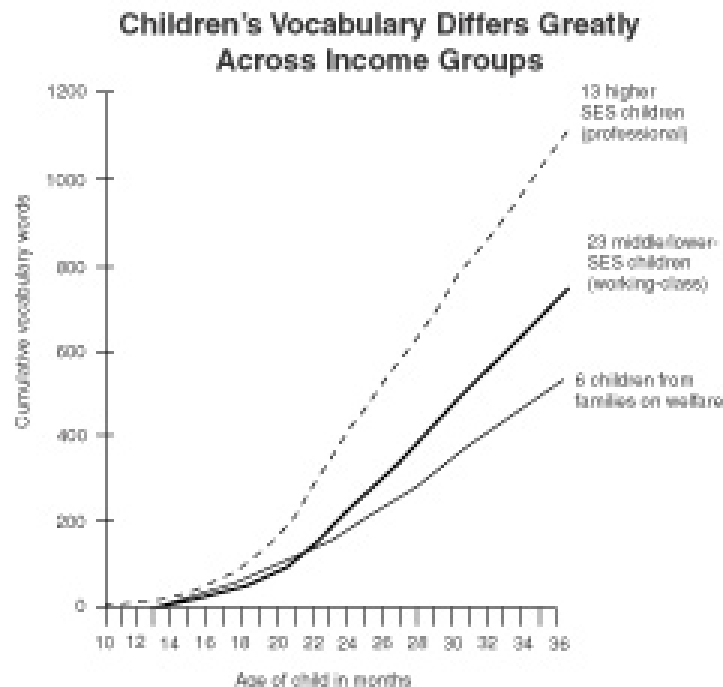
^b Parent utterances and different words were averaged over 13-36 months of child age. Child utterances and different words were averaged for the four observations when the children were 33-36 months old.

By the time the children were 3 years old, trends in amount of talk, vocabulary growth, and style of interaction were well established and clearly suggested widening gaps to come. Even patterns of parenting were already observable among the children. When we listened to the children, we seemed to hear their parents speaking; when we watched the children play at parenting their dolls, we seemed to see the futures of their own children.

We now had answers to our 20-year-old questions. We had observed, recorded, and analyzed more than 1,300 hours of casual interactions between parents and their language-learning children. We had dissembled these interactions into several dozen molecular features that could be reliably coded and counted. We had examined the correlations between the quantities of each of those features and several outcome measures relating to children's language accomplishments.

After all 1,318 observations had been entered into the computer and checked for accuracy against the raw data, after every word had been checked for spelling and coded and checked for its part of speech, after every utterance had been coded for syntax and discourse function and every code checked for accuracy, after random samples had been recoded to check the reliability of the coding, after each file had been checked one more time and the accuracy of each aspect verified, and after the data analysis programs had finally been run to produce frequency counts

and dictionary lists for each observation, we had an immense numeric database that required 23 million bytes of computer file space. We were finally ready to begin asking what it all meant.



It took six years of painstaking effort before we saw the first results of the longitudinal research. And then we were astonished at the differences the data revealed (see the graph at left).

Like the children in the Turner House Preschool, the three year old children from families on welfare not only had smaller vocabularies than did children of the same age in professional families, but they were also adding words more slowly. Projecting the developmental trajectory of the welfare children's vocabulary growth curves, we could see an ever-widening gap similar to the one we saw between the Turner House children and the professors' children in 1967.

While we were immersed in collecting and processing the data, our thoughts were concerned only with the next utterance to be transcribed or coded. While we were observing in the homes, though we were aware that the families were very different in lifestyles, they were all similarly engaged in the fundamental task of raising a child. All the families nurtured their children and played and talked with them. They all disciplined their children and taught them good manners and how to dress and toilet themselves. They provided their children with much the same toys and talked to them about much the same things. Though different in personality and skill levels, the children all learned to talk and to be socially appropriate members of the family with all the basic skills needed for preschool entry.

Test Performance in Third Grade Follows Accomplishments at Age 3

We wondered whether the differences we saw at age 3 would be washed out, like the effects of a preschool intervention, as the children's experience broadened to a wider community of competent speakers. Like the parents we observed, we wondered how much difference children's early experiences would actually make. Could we, or parents, predict how a child would do in school from what the parent was doing when the child was 2 years old?

Fortune provided us with Dale Walker, who recruited 29 of the 42 families to participate in a study of their children's school performance in the third grade, when the children were nine to 10 years old.

We were awestruck at how well our measures of accomplishments at age 3 predicted measures of language skill at age 9-10. From our preschool data we had been confident that the rate of vocabulary growth would predict later performance in school; we saw that it did. For the 29 children observed when they were 1-2 years old, the rate of vocabulary growth at age 3 was strongly associated with scores at age 9-10 on both the Peabody Picture Vocabulary Test-Revised (PPVT-R) of receptive vocabulary ($r = .58$) and the Test of Language Development-2: Intermediate (TOLD) ($r = .74$) and its subtests (listening, speaking, semantics, syntax).

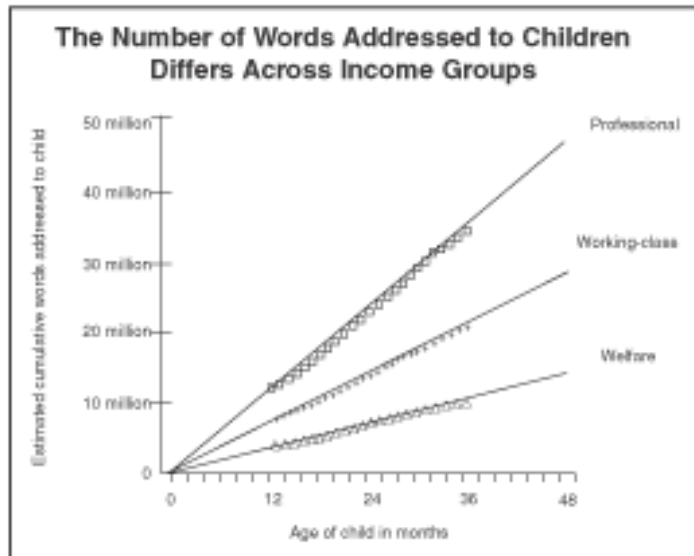
Vocabulary use at age 3 was equally predictive of measures of language skill at age 9-10. Vocabulary use at age 3 was strongly associated with scores on both the PPVT-R ($r = .57$) and the TOLD ($r = .72$). Vocabulary use at age 3 was also strongly associated with reading comprehension scores on the Comprehensive Test of Basic Skills (CTBS/U) ($r = .56$).

The 30 Million Word Gap By Age 3

All parent-child research is based on the assumption that the data (laboratory or field) reflect what people typically do. In most studies, there are as many reasons that the averages would be higher than reported as there are that they would be lower. But all researchers caution against extrapolating their findings to people and circumstances they did not include. Our data provide us, however, a first approximation to the absolute magnitude of children's early experience, a basis sufficient for estimating the actual size of the intervention task needed to provide equal experience and, thus, equal opportunities to children living in poverty. We depend on future studies to refine this estimate.

Because the goal of an intervention would be to equalize children's early experience, we need to estimate the amount of experience children of different SES groups might bring to an intervention that began in preschool at age 4. We base our estimate on the remarkable differences our data showed in the relative amounts of children's early experience: Simply in words heard, the average child on welfare was having half as much experience per hour (616 words per hour) as the average working-class child (1,251 words per hour) and less than one-third that of the average child in a professional family (2,153 words per hour). These relative differences in amount of experience were so durable over the more than two years of observations that they provide the best basis we currently have for estimating children's actual life experience.

A linear extrapolation from the averages in the observational data to a 100-hour week (given a 14-hour waking day) shows the average child in the professional families with 215,000 words of language experience, the average child in a working-class family provided with 125,000 words, and the average child in a welfare family with 62,000 words of language experience. In a 5,200-hour year, the amount would be 11.2 million words for a child in a professional family, 6.5 million words for a child in a working-class family, and 3.2 million words for a child in a welfare family. In four years of such experience, an average child in a professional family would have accumulated experience with almost 45 million words, an average child in a working-class family would have accumulated experience with 26 million words, and an average child in a welfare family would have accumulated experience with 13 million words. By age 4, the average child in a welfare family might have 13 million fewer words of cumulative experience than the average child in a working-class family. This linear extrapolation is shown in the graph below.



But the children's language experience did not differ just in terms of the number and quality of words heard. We can extrapolate similarly the relative differences the data showed in children's hourly experience with parent affirmatives (encouraging words) and prohibitions. The average child in a professional family was accumulating 32 affirmatives and five prohibitions per hour, a ratio of 6 encouragements to 1 discouragement. The average child in a working-class family was accumulating 12 affirmatives and seven prohibitions

per hour, a ratio of 2 encouragements to 1 discouragement. The average child in a welfare family, though, was accumulating five affirmatives and 11 prohibitions per hour, a ratio of 1 encouragement to 2 discouragements. In a 5,200-hour year, that would be 166,000 encouragements to 26,000 discouragements in a professional family, 62,000 encouragements to 36,000 discouragements in a working-class family, and 26,000 encouragements to 57,000 discouragements in a welfare family.

Extrapolated to the first four years of life, the average child in a professional family would have accumulated 560,000 more instances of encouraging feedback than discouraging feedback, and an average child in a working-class family would have accumulated 100,000 more encouragements than discouragements. But an average child in a welfare family would have accumulated 125,000 more instances of prohibitions than encouragements. By the age of 4, the average child in a welfare family might have had 144,000 fewer encouragements and 84,000 more discouragements of his or her behavior than the average child in a working-class family.

Extrapolating the relative differences in children's hourly experience allows us to estimate children's cumulative experience in the first four years of life and so glimpse the size of the problem facing intervention. Whatever the inaccuracy of our estimates, it is not by an order of magnitude such that 60,000 words becomes 6,000 or 600,000. Even if our estimates of children's experience are too high by half, the differences between children by age 4 in amounts of cumulative experience are so great that even the best of intervention programs could only hope to keep the children in families on welfare from falling still further behind the children in the working-class families.

The Importance of Early Years Experience

We learned from the longitudinal data that the problem of skill differences among children at the time of school entry is bigger, more intractable, and more important than we had thought. So much is happening to children during their first three years at home, at a time when they are especially malleable and uniquely dependent on the family for virtually all their experience, that

by age 3, an intervention must address not just a lack of knowledge or skill, but an entire general approach to experience.

Cognitively, experience is sequential: Experiences in infancy establish habits of seeking, noticing, and incorporating new and more complex experiences, as well as schemas for categorizing and thinking about experiences. Neurologically, infancy is a critical period because cortical development is influenced by the amount of central nervous system activity stimulated by experience. Behaviorally, infancy is a unique time of helplessness when nearly all of children's experience is mediated by adults in one-to-one interactions permeated with affect. Once children become independent and can speak for themselves, they gain access to more opportunities for experience. But the amount and diversity of children's past experience influences which new opportunities for experience they notice and choose.

Estimating, as we did, the magnitude of the differences in children's cumulative experience before the age of 3 gives an indication of how big the problem is. Estimating the hours of intervention needed to equalize children's early experience makes clear the enormity of the effort that would be required to change children's lives. And the longer the effort is put off, the less possible the change becomes. We see why our brief, intense efforts during the War on Poverty did not succeed. But we also see the risk to our nation and its children that makes intervention more urgent than ever.

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