

# **Consumer Home-Use Evaluation of a Developed Lean Ground Beef Product\***

by

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## **Abstract**

This study reports findings on the acceptance of a new lean ground beef product. Tested products involved 1) a Developed Lean product (less than 10% fat plus quality enhancers), 2) a Lean product (less than 10% fat without quality enhancers), and 3) a Market product (slightly

more than 20% fat). These products were home delivered on a rotating basis to a random sample of 91 households, one product each week for three weeks.

Product traits were evaluated by the household meal preparer at three stages of home use: preparing (5 traits), cooking (3 traits), and eating

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(4 traits), and by other household members at the final consumption stage of eating. More favorable ratings were observed for both Developed Lean and Lean products over the Market product at the preparing and cooking stages. Ratings at the eating stage were similar between the Developed Lean and the Market products indicating a favorable response to the Developed Lean product.

## Introduction

A distinctive characteristic of the 1980s was the heightened level of concern and attention many Americans gave to good health, and in particular to nutrition and overall physical fitness. With the beginning of the 1990s, health oriented consumers were estimated to comprise as much as half of the U.S. population (Burke Marketing Research). Pillsbury noted that 20 percent of the adult population can be classified as highly health-conscious in their meal preparation (Cook). Further, a 1990 study of selected attitudes toward meat and meat products indicated that 86 percent of those surveyed felt it was important to limit the amount of fat in one's diet (Dunkelberger et al.). This consciousness of personal and family health is expected to continue throughout the remainder of the century as the population ages. By the year 2000, the largest single segment (23% or 61.4 million people) of the population will be between the ages of 45 and 64 (Cook). Concerns about weight control, fat content, and calories will heighten as the public attempts to improve the quality of life and extend longevity.

Today, much of the American public is nutrition conscious and concerned about both the fat and cholesterol content of the foods it consumes. During the 1980s, there was a movement away from fatter meats to lower fat animal products (Breidenstein and Williams). Beef consumption decreased by almost 7 percent between the periods 1966-68 and 1986-88. During this 20-year period, the consumption of lean meats such as chicken and turkey rose 72 percent and 80 percent, respectively. The increase in poultry consumption was from 30.9 to 60.5 pounds per capita annually. At the same time, red meat consumption declined from 123.8 to 111.3 pounds per capita annually (a 10% decrease). Factors affecting these levels of consumption included:

greater diet and health concerns; increasing real disposable income; new meat products, especially more convenient ones; an aging population; smaller households; more single person households; and a growing proportion of ethnic minorities with different food preferences.

Several consumer studies reported a decrease in demand for beef beginning in the mid-1970s. Health concerns appeared to be the dominant factor behind this decline followed in importance by concerns about the fat content of the meat (Reichers et al.). Also contributing to decreased consumption was the departure of children from households and the overall aging of the remaining household members. Changes in consumer tastes and preferences along with the rising price of beef relative to poultry also seemed to contribute to this decline in consumption. Another study documented this substitution of broilers for beef by American consumers (Braschler) and concluded that the change was due in part to a reduction in the growth of real consumer income during the 1970-82 period versus the expanding consumer income that marked the period from 1950-69.

The beef industry continues to respond to these market forces by providing both new and more lean beef products. Ground beef is the most commonly used form of fresh beef, accounting for 44 percent of the total fresh beef cuts available for consumption. A pressing challenge to the beef industry is to develop new lean ground beef products that are acceptable in both nutrition and taste to diet conscious consumers (Breidenstein and Williams).

A new lean ground beef product developed in 1989 appears to meet consumer requirements for leanness and taste (Huffman and Egbert). This new development combines existing knowledge about the texture, juiciness, and flavor of currently marketed ground beef products with changes in the technologies used to produce these products. Current ground beef products contain 20 to 30 percent fat; lean and extra lean products have about 20 percent fat. This research team sought to produce a lean product containing less than 10 percent fat. Simple reduction or elimination of fat is often considered to be the most

efficient method for obtaining a lean product, but consumers often consider such a product less palatable than one with a fat content above 20 percent (Huffman and Egbert, p. 5). For this reason, researchers directed their efforts toward a "developed" lean product with less than 10 percent fat and sensory qualities equal to or exceeding those of currently marketed ground beef products. This product serves as the basis for this consumer evaluation study.

### **Purpose of the Study**

Newly developed food products require extensive testing to determine consumer response and potential market acceptability. Taste-tests conducted in a "laboratory" or a non-typical consumer environment are often used for this purpose. This procedure is used especially with foods such as meat products where spoilage and preparation are critical variables. Yet it is important that consumers evaluate new meat products in their own homes where the food is normally prepared and eaten. Controlled laboratory tests on the developed lean ground beef product had been completed with favorable results (Huffman and Egbert). Nonetheless, there remained questions about consumer acceptance of the product in the home environment. The objective of this home-use study was to determine acceptance of the "developed" ground beef product by household meal preparers and members (Dunkelberger et al.).

### **Method**

A taste-test panel method was used to compare three ground beef products. The products tested were: 1) Market product (A) - a current product containing 20 percent animal fat, 2) Lean product (B) - a lean product containing less than 10 percent animal fat, and 3) Developed Lean product (C) - a product containing less than 10 percent animal fat plus sensory enhancers. (For a detailed discussion of the Developed Lean product, also known as AU Lean, see Huffman and Egbert.) The research attempted to approximate the actual conditions under which American households most often use and evaluate new food products. The procedure required contacting a sample of households and asking people who nor-

mally plan and prepare the meals to participate in the study.

One motivation for meal preparers to volunteer their participation was free fresh ground beef products. Each household would receive four deliveries of ground beef in sufficient quantities to meet the need of the particular household. Deliveries were made weekly over a four-week period. In return, the meal preparer evaluated the particular ground beef product provided each week at three distinct stages of food preparation and use: preparing, cooking, and eating. Each week the household meal preparer rated the delivered ground beef product on twelve traits. Five traits (appearance, color, leanness, smell, and workability) were associated with preparation of the product, while three traits (amount of fat, amount of shrinkage, and overall appearance) were observable during the cooking process. The remaining four traits (liking, tenderness, flavor, and juiciness) were associated with the actual consumption of the cooked product at the dinner table. At the eating stage, consumer evaluations were also obtained from all other household members present at the meal in addition to the meal preparer. Measurement of each ground beef trait involved a 6-point hedonic scale employing contrasting descriptive words at either pole. Meal preparers were instructed to circle the one number from 0 to 5 that best described their rating of the ground beef product. A rating of 0 indicated a favorable and 5 an unfavorable response.

The different ground beef products were delivered fresh (not frozen). Instructions to the meal preparer were to refrigerate but not freeze the products until used. A product was to be used within a few days of receipt. Each week a new delivery of another ground beef product was made and the completed product evaluations for the previous week were collected.

**Table 1. Selected Characteristics of Households Participating  
In Consumer Acceptance Study of Alternative Ground Beef Products, Fall 1989**

Household Characteristic	Unit	Level
Couple (head and spouse)	Pct.	80
Minority (nonwhite)	Pct.	30
Three or more members	Pct.	48
Average age of household heads	Yrs.	50

Design of the study involved creation of three independent test panels for replication purposes and to eliminate any impacts associated with the order in which the ground beef products were received. The original design called for 30 households in each panel to represent all population segments within a mid-sized city. Participant mortality was expected to be about 20 percent over the duration of the study leaving anticipated panels of 24 households in all four evaluations.

A system of random telephone numbers was used to provide the sample of households. When contacted by telephone, household meal preparers or spouses were informed about the study and asked whether household members would be willing to participate. All volunteer households were asked to answer a few background questions designed to provide information concerning the location of their house within the city, size of household, times when a household member was usually at home, and a few other descriptive characteristics. After the required sample of 90 households (91 actually began the study) was identified, each household was randomly assigned to one of the three test panels.

The testing process was initiated with the delivery of ground beef products for the first week. Each taste panel was provided a different product for each of the three test periods. Household meal preparers were instructed to use the product in patties; however, they could use their regular recipes, cooking methods, and condiments. For a fourth delivery, all three panels received the Developed Lean product and were instructed to use it in any meat dish they desired.

The focus of this paper is on the product evaluations from the first three test weeks. Product assessments of the household meal preparers for all three evaluation stages provide most of the data analyzed. This is supplemented with eating stage data provided by other household members who consumed the products.

#### **Panel Participation and Characteristics of Sample**

As expected with any research involving longitudinal testing over a period of time, some sample participant mortality occurred. Eighty-five percent of the 91 households beginning the study participated in all three product tests by completing their evaluation forms each week. Seven households (8%) failed to complete any of the evaluations satisfactorily and were eliminated from the study.

The original sample of households consisted of 80 percent couples, and 48 percent included at least three members (Table 1). Thirty percent of the households were nonwhite and 48 percent had incomes below \$30,000. The average age of household heads was 50 years.

#### **Results**

Product traits evaluated at the food preparing stage included the traits of overall appearance, color, leanness, smell, and workability (Table 2). Both the appearance and leanness traits differed significantly between the Market (Product A) and the Lean (Product B) and Developed Lean (Product C) products. For appearance, a mean rating

**Table 2. Meal Preparer Evaluation of Alternative Ground Beef Products During Preparing Stage, Fall 1989**

Preparing stage traits and products <sup>b</sup>	Rating <sup>a</sup>						Mean
	0	1	2	3	4	5	
	----- Pct. -----						
<b>Appearance (Good=0, Poor=5):</b>							
Product A - Market	50	27	14	8	1	0	.82 <sup>c</sup>
Product B - Lean	73	22	4	0	0	1	.37
Product C - Developed Lean	64	26	7	3	0	0	.48
<b>Color (Good=0, Poor=5):</b>							
Product A - Market	55	27	9	5	4	0	.75 <sup>d</sup>
Product B - Lean	71	21	4	4	0	0	.39
Product C - Developed Lean	67	17	12	4	0	0	.53
<b>Leanness (Lean=0, Fatty=5):</b>							
Product A - Market	38	23	15	15	6	3	1.37 <sup>c</sup>
Product B - Lean	66	21	11	1	0	1	.53
Product C - Developed Lean	59	25	14	0	2	0	.63
<b>Smell (Good=0, Poor=5):</b>							
Product A - Market	60	25	8	4	2	1	.68 <sup>d</sup>
Product B - Lean	70	24	5	0	1	0	.38
Product C - Developed Lean	63	28	8	0	1	0	.49
<b>Workability (Easy=0, Difficult=5):</b>							
Product A - Market	54	29	13	4	0	0	.66
Product B - Lean	66	22	11	1	0	0	.46
Product C - Developed Lean	63	21	11	1	4	0	.63

<sup>a</sup>A rating of 0 is favorable while a rating of 5 is unfavorable.

<sup>b</sup>Households: Market (n=80), Lean (n=78), Developed Lean (n=72).

<sup>c</sup>The difference between this mean rating and those for the two lean products (B and C) were significant at the .05 level.

<sup>d</sup>The difference between this mean rating and the mean rating for the Lean product (B) was significant at the .05 level.

of .82 was recorded for the Market product, compared to more favorable mean ratings of .48 and .37 for Developed Lean and the Lean products, respectively. Similarly, for the leanness trait, Lean and Developed Lean products were favored with mean ratings of .53 and .63, respectively, over the Market product with a mean rating of 1.37. Only 38 percent of the meal preparers gave a very favorable leanness rating of 0 to the Market product, while 59 and 66 percent did so for Developed Lean and Lean products, respectively.

Traits of color, smell, and workability showed similar rating patterns, but had less differentiation between the mean rating scores for the three ground beef products. For workability in particular, only minor ratings differences were observed for the Market and Developed Lean products (mean scores of .66 and .63 respectively). However, the percentage distributions indicate that the mean rating for Developed Lean was the result of three preparers (4%) who gave this product poor ratings of "4." On the other hand, for the two traits of color and smell, the Market product received significantly less favorable ratings than the Lean Product B, but not significantly less than Developed Lean.

**Table 3. Meal Preparer Evaluation of Alternative Ground Beef Products During Cooking Stage, Fall 1989**

Cooking traits and products <sup>b</sup>	Rating <sup>a</sup>						Mean
	0	1	2	3	4	5	
	----- Pct. -----						
Amount of fat (Small=0, Excessive=5):							
Product A - Market	25	31	11	14	13	6	1.77 <sup>c</sup>
Product B - Lean	65	23	8	3	1	0	.51
Product C - Developed Lean	58	27	12	3	0	0	.60
Amount of shrinkage (Small=0, Excessive=5):							
Product A - Market	34	37	20	3	5	1	1.11 <sup>c</sup>
Product B - Lean	55	34	9	1	1	0	.59
Product C - Developed Lean	54	34	11	1	0	0	.60
Overall appearance (Good=0, Poor=5):							
Product A - Market	52	27	11	9	1	0	.81 <sup>c</sup>
Product B - Lean	66	24	9	1	0	0	.45
Product C - Developed Lean	63	29	7	1	0	0	.47

<sup>a</sup>A rating of 0 is favorable while a rating of 5 is unfavorable.

<sup>b</sup>Households: Market (n=80), Lean (n=78), Developed Lean (n=72).

<sup>c</sup>The difference between this mean rating and the mean ratings for the two lean products (B and C) were significant at the .05 level.

**Table 4.** Meal Preparer Evaluations of Alternative Ground Beef Products During Eating Stage (Consumption), Fall 1989

Consumption traits and products <sup>b</sup>	Rating <sup>a</sup>						Mean
	0	1	2	3	4	5	
	----- Pct. -----						
Like (Very much=0, Dislike very much=5):							
Product A - Market	40	24	13	9	11	1	1.34
Product B - Lean	40	26	22	7	4	1	1.12
Product C - Developed Lean	42	29	21	7	1	0	.96
Tenderness (Very tender=0, Very tough=5):							
Product A - Market	40	28	14	8	8	2	1.20
Product B - Lean	43	32	12	7	5	1	1.03
Product C - Developed Lean	45	26	19	8	0	2	.95
Flavorfulness (Very good=0, Very poor=5):							
Product A - Market	38	21	23	8	9	1	1.32
Product B - Lean	38	29	17	8	6	2	1.27
Product C - Developed Lean	40	32	20	7	1	0	.96
Juiciness (Very juicy=0, Very dry=5):							
Product A - Market	24	27	25	13	9	2	1.61
Product B - Lean	31	27	18	9	8	7	1.55
Product C - Developed Lean	30	25	19	14	8	4	1.58

<sup>a</sup>A rating of 0 is unfavorable while a rating of 5 is unfavorable.

<sup>b</sup>Households: Market (n=80), Lean (n=78), Developed Lean (n=72).

Three product traits associated with cooking were tested: amount of fat produced, amount of shrinkage, and overall appearance (Table 3). In the cooking stage meal preparers decisively preferred the lean products. They rated both lean ground beef products significantly higher than the Market product for all three traits. These differences were particularly pronounced when the amount of fat was considered. Only 25 percent of preparers gave the Market product the very favorable rating of 0 compared to 58 percent for Developed Lean and 65 percent for the Lean. Similar patterns among percentages and mean ratings were observed for the amount of shrinkage and overall appearance traits, but these differences were not as pronounced.

While taste-test evaluations of Developed Lean (Product C) had been completed previously in controlled laboratory situations (Huffman and Egbert), the ultimate test of a household consumption product involves its acceptance by consumers within their homes. For this evaluation at the household level, meal preparers and other household members rated four eating stage consumption traits: general liking, tenderness, flavor, and juiciness. No significant differences in preparer mean ratings were observed among the three products for any of the four traits (Table 4). Evaluations of juiciness by meal preparers were highly consistent for all three products, varying by only .06 points. Somewhat larger differences were observed for the other three traits, with

Developed Lean consistently having the most desirable, i.e., lowest scores. The meal preparers "liked" Developed Lean better than the Market (Product A), rated it better for tenderness, and found it more flavorful. While the Lean product was often rated more desirable than the Developed Lean product at the preparing and cooking stages, Developed Lean was consistently given a more favorable rating than the Lean product at the eating stage for liking, tenderness, and flavor. The product development goal was to create a new lean ground beef product that compared favorably both to an "ultra" lean product and to current market products. These results indicate that Developed Lean meets and exceeds the challenge.

When extending the analysis to other participating household members, the primary observation was that all eating stage ratings were less favorable than those provided by the meal preparers (Table 5). However, the same pattern of taste ratings was present; that is, Developed Lean received more favorable ratings for the traits of general liking (1.23), tenderness (1.23), and flavor (1.15). Developed Lean was judged significantly more flavorful than the Market (Product A). Virtually no ratings differences among the three products were found for the juiciness trait, a finding consistent with that observed for the meal preparer evaluations.

**Table 5.** Other Household Member Evaluations of Alternative Ground Beef Products During Eating Stage (Consumption), Fall 1989

Consumption traits and products <sup>b</sup>	Rating <sup>a</sup>						Mean
	0	1	2	3	4	5	
	----- Pct. -----						
Like (Very much=0, Dislike very much=5):							
Product A - Market	18	33	22	7	16	4	1.85
Product B - Lean	29	29	25	9	6	2	1.41
Product C - Developed Lean	24	40	26	5	2	3	1.29
Tenderness (Very tender=0, Very tough=5):							
Product A - Market	24	34	11	13	16	2	1.69
Product B - Lean	27	38	16	8	9	2	1.43
Product C - Developed Lean	32	30	24	8	1	5	1.29
Flavorfulness (Very good=0, Very poor=5):							
Product A - Market	24	18	31	13	11	3	1.82 <sup>c</sup>
Product B - Lean	24	32	22	6	10	6	1.65
Product C - Developed Lean	31	32	29	8	0	0	1.15
Juiciness (Very juicy=0, Very dry=5):							
Product A - Market	11	23	33	22	7	4	2.02
Product B - Lean	19	25	19	16	11	10	2.03
Product C - Developed Lean	15	27	21	16	11	10	2.11

<sup>a</sup>A rating of 0 is favorable while a rating of 5 is unfavorable.

<sup>b</sup>Households: Market (n=55), Lean (n=63), Developed Lean (n=62).

<sup>c</sup>Market product is significantly different from the Developed Lean at the .05 level.



In order to provide a multi-dimensional rating for the various traits associated with the three evaluation stages, a single composite measure was constructed. At the preparing stage, the individual trait ratings for appearance, color, leanness, smell, and workability were summed for each household meal preparer. This number provided a composite preparing scale with a score range of 0 to 25 (Table 6). The same procedure was used to create a composite cooking scale with a score range of 0 to 15 by summing trait scores for the amount of fat, amount of shrinkage, and appearance. A composite eating scale with a score range of 0 to 20 was created by summing the rating scores for overall liking, tenderness, flavor, and juiciness.

Summarizing across the three products at each stage, these composite scores revealed that the Market (Product A) received the least favorable ratings; that is, it had the highest mean rating scores at both the preparing (4.28) and cooking (3.70) stages (Table 6). In contrast, Lean Product B received the best ratings (2.08 and 1.55, respectively) at these two stages. Developed Lean did not rate as well as Lean with ratings of 2.77 and 1.67, but it was rated significantly better than the Market product at both stages. Moreover, the differences in mean ratings between the Lean and Developed Lean products were not statistically significant.

The critical evaluation in any consumer acceptance study is the taste comparisons among similar products. In this particular study, the goal was to determine whether a lean ground beef product can have an ultra low fat content (compared to existing market products) and still satisfy consumer taste preferences. Therefore, Developed Lean must accomplish at least two things: 1) have acceptable preparation and cooking characteristics and 2) receive a taste rating equal to or better than existing market products containing much higher animal fat content.

Findings show that both desired conditions for the Developed Lean product were met. First, there was much consistency in the product ratings for Developed Lean at the preparing and cooking stages. Developed Lean was rated better than the market product in each case. Second, Developed

Lean not only equalled the Market product in taste, it received a more favorable rating. The mean rating of 4.44 for Developed Lean was better than the rating of 5.47 received by the market product. Although none of these observed differences were statistically significant, Developed Lean clearly satisfies sensory and palatability perceptions of consumers in this test.

## Discussion and Implications

Results of this product evaluation indicate favorable perceived differences between a current Market type ground beef product which contained 20 percent fat and two lean alternatives which contained less than 10 percent fat. Compared to the Market product, participating meal preparers gave Developed Lean (the test product) favorable sensory ratings at the preparing and cooking stages and reported no unfavorable palatability distinctions at the eating stage. Thus, Developed Lean, consisting of less than 10 percent fat plus select quality enhancers, should have widespread acceptance among consumers.

The acceptance of Developed Lean under test conditions of product anonymity is encouraging for the beef industry. Many consumers are aware of potential health risks associated with high levels of fat in their diets. The availability of a reduced fat red meat product with desirable sensory and palatability qualities provides consumers a more healthy alternative and allows greater dietary flexibility in meal planning.

However, consumer willingness to pay a higher price in the supermarket for a developed lean ground beef product could not be determined from the analysis. Meal preparers reported only a very small difference in the price they would pay for Developed Lean over the other two test products. But this attempted market analysis, by design, masked explicit identification of the alternative products and their unique differences. Thus, the meal preparers did not have a clear perception of the benefits provided by the Developed Lean product. This hindered the effort to obtain a clear specification of willingness to pay. With information about the health enhancing aspects of Developed Lean, in light of their favorable evaluations and expressed health conscious-

**Table 6. Meal Preparer Composite Evaluations of Alternative Ground Beef Products During Preparing, Cooking, and Eating (Consumption) Stages, Fall 1989**

Product rating score	Use Stages and Ground Beef Products											
	Preparing			Cooking			Eating					
	Market	Lean	Dev. Lean	Market	Lean	Dev. Lean	Market	Lean	Dev. Lean	Market	Lean	Dev. Lean
25-26	--	--	--	--	--	--	--	1.3	--	--	1.3	--
23-24	--	--	--	--	--	--	1.3	1.3	1.3	1.4	1.3	1.4
21-22	1.3	--	--	--	--	--	6.3	3.9	--	--	3.9	--
19-20	--	--	--	--	--	--	5.0	2.6	5.0	1.4	2.6	1.4
17-18	2.5	--	--	--	--	--	3.8	5.2	3.8	5.4	5.2	5.4
15-16	3.8	--	--	--	--	--	7.6	7.8	7.6	6.8	7.8	6.8
13-14	1.3	2.6	2.7	--	--	--	11.4	9.1	11.4	12.3	9.1	12.3
11-12	6.3	1.3	1.4	3.8	--	--	17.7	14.3	17.7	19.2	14.3	19.2
9-10	3.8	1.3	4.1	6.4	1.3	1.4	11.4	14.3	11.4	13.7	14.3	13.7
7-8	8.9	3.9	8.2	12.7	3.9	1.4	19.0	16.9	19.0	14.3	16.9	14.3
5-6	11.4	10.5	4.1	15.2	3.9	8.2	16.5	23.4	16.5	27.4	23.4	27.4
3-4	10.1	13.2	20.5	13.9	19.5	17.8	(79)	(77)	(79)	(73)	(77)	(73)
1-2	27.9	14.5	19.2	27.9	24.7	31.5	5.47	5.04	5.47	4.44	5.04	4.44
0 (Best)	24.1	52.6	39.7	20.3	46.8	39.7	0-20	.942	0-20	.3916(NS)	0-20	.942
Preparers	(79)	(76)	(73)	(79)	(77)	(73)	Market from the lean products					
Mean Score	4.28	2.08	2.77	3.70	1.55	1.67	Market from the lean products					
Scale range	0-25			0-15			Market from the lean products					
F ratio	6.569			17.115			Market from the lean products					
Probability	.0017(S)			.0000(S)			Market from the lean products					
Direction	Market from the lean products			Market from the lean products			Market from the lean products					

ness, consumers probably would indicate a larger price differential.

Both lean products involve higher costs per unit. The costs for producing the Lean and the Developed Lean products are approximately 20 and 12 percent higher, respectively, than for the Market product. This cost differential between the two lean products results from the fact that water replaces some of the fat in the Developed Lean product to maintain its juiciness, whereas a small quantity of meat replaces fat in the Lean product. The retail price must be sufficient to cover this cost differential plus provide funds for market development and any potential market risks. Thus, any lean ground beef product will carry a higher price tag at the supermarket counter than the ground beef products consumers currently purchase, but this price for Developed Lean will be less than it would be for a similar Lean product without enhancers.

Indications are that the beef industry recognizes the concerns of today's consumers and the potential market for such a lean product. Already a Developed Lean ground beef patty patterned after the Developed Lean product tested has been further tested and integrated into the product line of a major fast food chain. Also, a major domestic and international theme park is evaluating the product for its outlets, and the USDA is testing the product for inclusion in the National School Lunch Program. Positive results from these evaluations could have major implications for the future of the beef industry both at the production and processing levels.

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