A Product Launch Strategy for Kid Science

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EXECUTIVE SUMMARY

Kid Science is preparing to release a product in the educational toy and book market. As a start-up company, they need to develop a business strategy concerning the manufacturing, marketing, and design of their initial product. We recommend the following strategy:

- Manufacture the product as a *Virtual Corporation.* Contract the printing, laminating, cutting, and assembly of the first product with an outside manufacturer.
- Market the initial product using a Test the Waters approach. Set a reasonable price (around $35), focus on local promotions rather than traditional advertising, and distribute directly to specific retail stores.
- Produce the most consumer-preferred product design. Use the gender-neutral narrating character, current colors and format, and provide more explanation of concepts.

These strategies will most fully satisfy Kid Science's goals of building a sustainable business that is both rewarding and enjoyable.

Kid Science should also undertake further research into specific marketing costs and spend less time considering the fixed costs associated with manufacturing the product.

INTRODUCTION

"Kid Science is a company seeded in the belief that education is a non-fat thinking venture . . . It endeavors to create products explaining the most abstract of ideas through non-conventional format and analogy. "

'This will either be a big hit or it will fall flat on its non-flat face."

- Kid Science founder

Company Background

Kid Science (a pseudonym) is a recent start-up venture by three Stanford students. Their mission is to provide innovative toys and tools to children ages 6-11 for the purpose of teaching abstract scientific concepts. The company has already obtained some initial funding and has developed a prototype for their first product. They are currently seeking further funding and are in the process of developing a business plan to present to prospective investors. Although they have performed extensive market research and have completed a first round of product testing, many of the key business decisions have not yet been solidified, including the final format of the product.

Product Description

The initial product, and the focus of this study, is a proprietary book/toy, whose pages fit together somewhat like a jigsaw puzzle. Kid Science has developed a few different variations of the prototype which have been used in market research. The company plans to introduce a series of books, entitled *Interconnections,* based on the initial prototype . This series has the goal of introducing abstract scientific concepts such as light, color, and electricity and focusing on how these concepts connect together. The connections are highlighted by the physical fitting-together of the puzzle pieces. The theme of the series, and a founding belief of Kid Science, is that "education is a non-flat thinking venture" (Kid Science founder).

Market Description

The children's book market is a $3.5 billion a year market. It is highly segmented, involvmg hundreds of small to mid sized companies. Volumes are typically low, margins average anywhere from 30% to 50%, and product diffusion tends to be slow, particularly with educational books.

We performed a Porter Five Forces of Competition analysis of Kid Science's position in the market in order to gain insight into the important issues that the company will be facing in the near future. The main results of our analysis are as follows:

Entry barriers including brand recognition and cost advantages are the most critical forces that Kid Science is currently facing.

- Product differentiation and advertising will be critical to overcoming brand recognition
- The optimal business plan may require a short term loss in order to overcome the initial cost barriers

The detailed analysis and Porter diagram may be found in Appendix A.

Problem Statement

In this study we developed a strategic plan for marketing and manufacturing Kid Science's initial product. This marketing strategy includes an optimal plan for advertising, distribution, product pricing, and selecting product attributes. The manufacturing plan addresses the key issues of where and how Kid Science should begin production. The goal of the plan is to help create a viable, self-sustaining business without sacrificing the educational mission on which the company is founded.

Throughout this study we worked extensively with Kid Science in order to insure that our analysis and approach addressed the needs of our client and reflected their judgment on key issues to the fullest extent possible.

PROBLEM FORMULATION

General Approach

We structured Kid Science's problem using the framework of decision analysis. We explicitly defined the decisions under control of Kid Science, the uncertainties they face, and their values as a company. Decision analysis allows us to recommend the actions that lead to the greatest expected value for Kid Science.

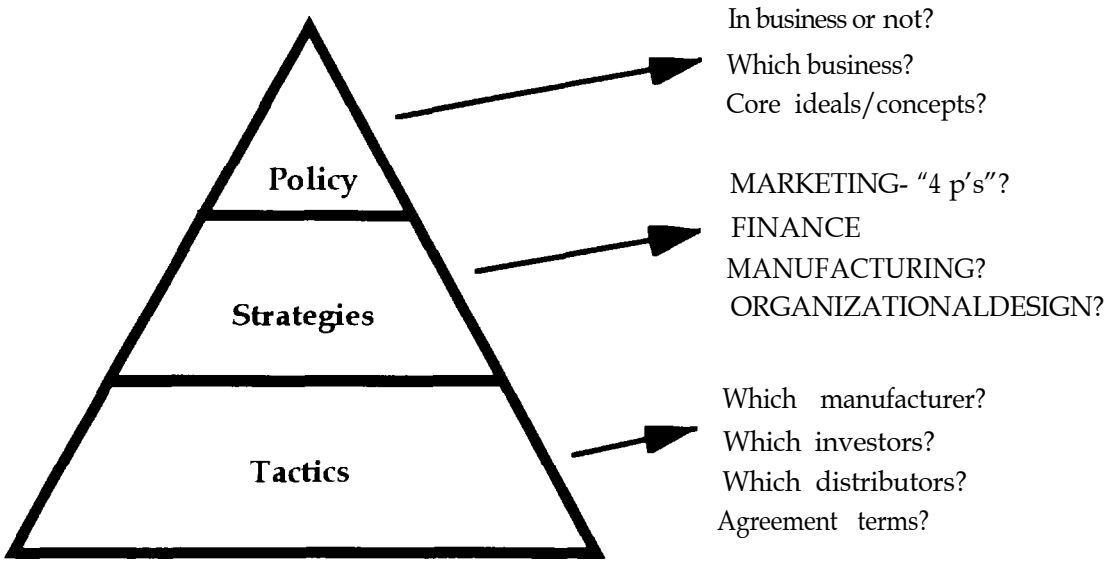
We supplemented the main decision model with two additional models of consumer demand for Kid Science's initial product. We developed a model of consumer preferences using conjoint analysis. This technique quantifies consumers' preferences for product attributes such as color and price. We also created a model to estimate the diffusion of Kid Science's product into the market. This new product diffusion model demonstrates the effects of different marketing strategies on Kid Science's expected sales over time.

In the sections below, we describe the development of the main decision model. We also discuss how the consumer demand models were used during the decision analysis evaluation.

Decision Hierarchy

Kid Science is facing a tremendous number of decisions, ranging from very specific tactical inquiries to very broad policy-based decisions. We focused our analysis between these two, at the strategic level, depicted in Figure 1. Certain policy decisions were accepted as given such as whether or not Kid Science should actually form their company. In addition, we did not delve into the tactical details of fully implementing their strategies. Specific distribution locations, advertising media, and supplier partnerships were not analyzed.

Figure 1: Decision hierarchy



Decision Model

The decision model is characterized by decisions under Kid Science's control, uncertainties that are not under their control, and a measure of value that Kid Science places on the possible outcomes of their situation. Each of these areas is defined below. A compact picture of the decision model is the influence diagram of Figure 2.

Identifying Decisions

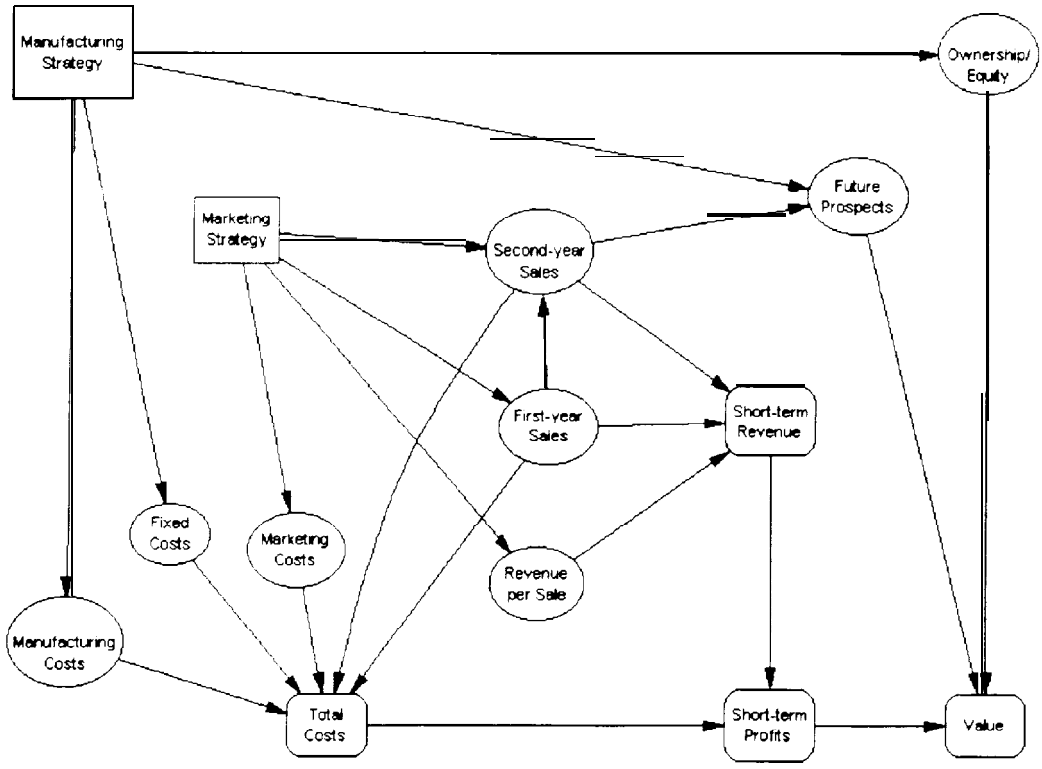
We examined two strategic areas of decisions: manufacturing and marketing. Kid Science must choose a manufacturing arrangement for their initial product and define the amount of their involvement in printing, laminating, and assembling it. Kid Science must also determine the marketing mix variables associated with their product, including price, advertising channels, and distribution channels. These decisions are shown in Table 1.

Table 1: Decisions and alternatives for Kid Science

Decisions

Manufacturing	Price	Distribution	Advertising
Vertical Integration	**$25**	**Catalog**	**All Out**
Virtual Corporation	$35	Distributor	Dense Regional
Value-Chain Partner	$50	Retail Direct	Spot Regional
			Local

Figure 2: Influence diagram representing Kid Science's problem



Manufacturing

Kid Science is considering three plans for manufacturing their product: *Vertical Integration, Virtual Corporation* and *Value-Chain Partnership* Under the *Vertical Integration* plan, Kid Science will print, laminate, and assemble the product themselves. *Vertical Integration* requires that Kid Science purchase equipment, lease production space, and hire labor to do the manufacturing.

As a Virtual Corporation, Kid Science will contract the production of their initial product to outside manufacturers. Kid Science would only require space for the product design and development.

Under the *Value-Chain Partnership,* Kid Science will form a partnership with a local manufacturer. They will trade ownership of the company for access to manufacturing equipment.

Price

Kid Science is considering three price alternatives for their initial product: $25, $35, and $50. Each is defined to be the consumer's eventual purchase price.

Distribution

The distribution alternatives reflect three types of channels available to Kid Science, rather than specific retailers or distributors. Kid Science could sell their product to catalog-producers, who would then sell to consumers via mail order. They could also use an intermediary distributor who would in turn sell the product to retail stores. Finally, Kid Science could sell the product directly to retail stores themselves.

Advertising

The advertising alternatives also reflect general types of advertising campaigns, rather than specific combinations of promotional media. The all-out strategy is characterized by widespread exposure through many different media. A dense *regional* campaign focuses on many media, but in a smaller geographic area. The *spot regional* campaign targets a similar geographic region, but uses fewer media. Finally, the local alternative is similar to spot *regional,* but is limited to a very small geographic region.

Generating Marketing Strategies

Rather than consider all possible combinations of marketing variables, we represented the price, advertising, and distribution decisions as a single marketing strategy decision. Each alternative strategy is a coherent theme that corresponds to a particular combination of price, advertising campaign, and distribution channel. The four marketing strategies are shown in Table 2.

Table 2: *Kid Science marketing strategies*

Marketing Strategy	*Price*	*Distribution Channel*	*Advertising Campaign*
Mercedes	**$50**	Retail Direct, Catalog	Spot Regional
Mass Diffusion	**$25**	Retail Direct, Catalog, Distributor	All Out
Controlled Growth	**$35**	Retail Direct, Distributor	Dense Regional
Test the Waters	**S33**	Retail Direct	Spot Regional

Mercedes

The *Mercedes* strategy targets upper-income families who are willing to pay a high price for a high-quality product. The product might be sold in educational/gadget stores such as The Nature Company, Learningsmith, and Scientific Revolution. The product might also

appear in airline mail-order catalogs and other high-profile outlets. The educational philosophy and high quality of the product will be promoted extensively.

Mass Diffusion

The goal of *Mass Diffusion is* to achieve widespread acceptance of the product and its associated teaching methods. Kid Science will set the lowest possible price and conduct an intense advertising blitz in order to generate as many sales as possible.

Controlled Growth

The intent of the Controlled Growth strategy is to pursue the market at a constant pace with the hope of gradually building for the future.

Test the Waters

The Test the Waters theme represents a cautious introduction of the product. A variety of retail outlets will be used, ranging from high-end gadget stores to more general book and toy stores.

Our decision model now consists of two general strategic decisions: manufacturing strategy and marketing strategy. The actions that Kid Science takes will affect the sales of their product and their costs of doing business. Under the decision analytic framework, the precise effects on these variables is uncertain. The principle uncertainties facing Kid Science are described below.

Identifying Uncertainties

This is a difficult decision problem for Kid Science because they are unsure of their manufacturing and marketing costs, demand for the product, and future profitability. Each of these uncertainties is represented in the influence diagram (Figure 2) and defined below.

Sales

The key uncertainty facing Kid Science is the demand for their initial product. We examined a two-year time horizon for sales and defined first-year safes and *second-year sales* as the number of units sold by Kid Science in the first and second years, respectively. In our model, demand for the product is influenced by the marketing strategy (price, advertising, and distribution variables) Kid Science selects.

Although we examined sales out to the tenth year, the sales levels after the second year were not the focus of our decision model for three reasons.

- The first two years sales will be critical to the survival of the company, and as such Kid Science was primarily focused on the first two years.
- After two years, the company will probably regroup and restrategize. For instance, they may wish to change their advertising and distribution strategies, or may wish to release a new product. For this reason, we believe that our sales projection over the long-run will not be accurate.
- Our sales model is a static model in the sense that the parameters do not change in time. However, in reality these parameters will change both with changes in Kid Science's strategies and with time. Thus, the sales model is increasingly unreliable over time.

Revenue per sale

Another uncertainty is the average amount of revenue Kid Science receives from the sale of one product. If Kid Science distributes directly to retailers, Kid Science will make more money per unit than if they use an intermediary distributor. Thus, the average revenue per sale is also influenced by the selection of a marketing strategy.

Costs

We modeled three types of costs. Manufacturing Costs are the average variable costs associated with producing each book. Fixed Costs are the costs associated with constructing the manufacturing operation. Marketing Costs represent the costs of advertising and establishing distribution channels. Both Manufacturing Costs and Fixed Costs depend upon Kid Science's manufacturing decision. Marketing Costs are influenced by their selection of marketing strategy.

Future Prospects

Kid Science hopes their first product positions them for future success. We modeled this notion as an uncertainty called future prospects. This variable can take on one of four possible states, corresponding to four scenarios describing Kid Science's future success. These scenarios are shown in Table 3. If the blockbuster state is realized, Kid Science has indeed unleashed the wave of the future in children's toys. Hopeful indicates that the initial product has given Kid Science a presence in the market and a customer base upon which to build. Hopeful may also indicate that Kid Science has some form of competitive advantage in the form of manufacturing process knowledge. The dismal state corresponds to a lack of

real competitive advantage and poor future prospects. Finally, bust indicates that the venture was simply ill-fated and ends in a significant financial loss.

The future prospects of Kid Science depend on the initial market reaction: sales during the first two years provide an obvious indication of future success for the company. Kid Science's manufacturing strategy can also influence their future prospects Large investment in manufacturing equipments will worsen their future prospects if initial sales are low. Conversely, an intimate understanding of the production process could be a source of competitive advantage if sales are promising.

Table 3: *Scenarios of Kid Science's future prospects*

Future Prospect	*Description*
Blockbuster	Widespread, immediate success
Hopeful	Established, but possibly tentative, customer base
Dismal	Lack of competitive advantage
Bust	Bankruptcy

Ownership

Since Kid Science values maintaining both control and ownership of their company, we explicitly modeled their level of ownership. We defined this uncertainty as the percentage of equity in the company held by Kid Science after two years. Ownership is influenced by their manufacturing decision, since they may have trade equity for start-up funds from investors.

The combination of decisions and uncertainties described above results in a set of possible outcomes for Kid Science. In order to recommend a decision policy, we established a value model to define Kid Science's preferences over these possible outcomes.

Value Model

The overall mission of Kid Science is to offer an innovative and non-traditional way for children to learn abstract concepts, and to sustain a healthy business that is "fun to manage"(Founder, Kid Science). They are willing to forego some profit in order to reach more people with their ideas. They are also willing to trade financial success with maintained control over an enterprise that provides them with an enjoyable experience.

Given this mission statement, we modeled the values of Kid Science as a combination of three factors. First, they are concerned with the profits that result directly from this product. Second, they value the future profitability of their business based on the success of their first product. Finally, they value control over their business, which we modeled as percent ownership of the company. Our value model reflects an implicit assumption that Kid Science would be dissatisfied with less than 50% ownership of the company.

Evaluation Methods

In this formulation section, we have described our model of Kid Science's strategic decision. As mentioned above, such models are evaluated using decision analysis techniques. The results of our evaluation are fully detailed in the Analysis section. However, it is useful to mention here the special role of our conjoint analysis and new product diffusion model.

Although we have identified the uncertainties present in Kid Science's decision, we have yet to quantify them. In the decision analytic methodology, uncertainties are assessed by quantifying an expert's beliefs as a probability distribution. These distributions are based on the background state of information of the expert. We used our conjoint analysis and new product diffusion model to construct this state of information. Our assessments of the uncertainties in the decision model are made with the insights gained from building the background state of information.

ANALYSIS

The results of our analysis are described in this section. We begin with the most detailed level of our analysis, exploring consumer behavior through conjoint analysis. The results of the conjoint analysis contribute to our new product diffusion model. Finally, the diffusion model is used to help assess uncertainties in the overall decision model.

Conjoint Analysis

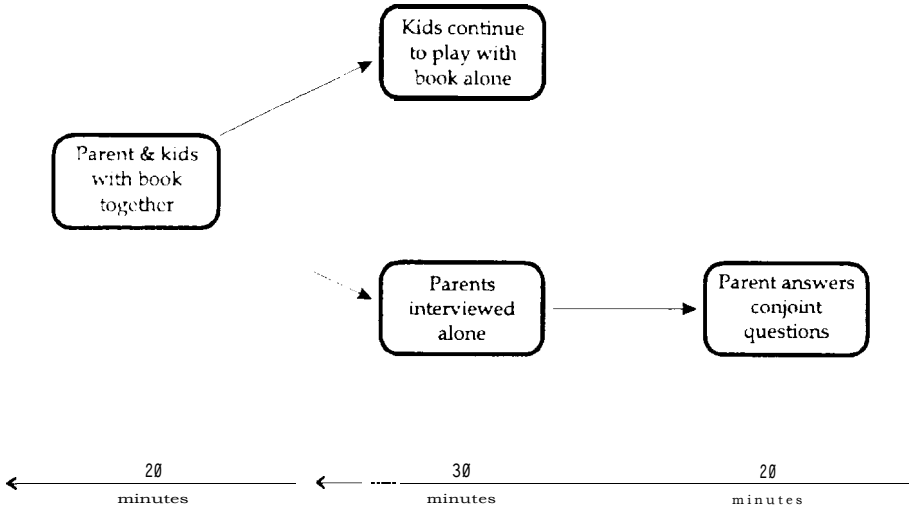
The Consumer Research Process

Kid Science is in the final stages of specifying the design of its initial product. One of their highest priorities throughout this stage is to elicit feedback from potential consumers to identify areas where they can improve the desirability of their product. Another major aspect of their consumer research is to determine an appropriate pricing strategy for their product. Our project group assisted Kid Science in both of these endeavors by performing conjoint analysis studies in conjunction with conducting market research focus groups.

There were a total of three focus group sessions held. Conjoint analysis data was collected from 14 people in total. Eight of these subjects were interviewed during the group sessions, while an additional six subjects were interviewed individually to gather conjoint data. Individuals were selected to participate in the sessions because they matched the general profile of the market segments that Kid Science intends to target with its initial book: educated, younger parents with income (or near future income) of at least $50,000 per year.

The focus group sessions consisted of three primary stages. First, kids and parents observed the book together. The kids were then left to investigate the book more thoroughly by themselves and were asked several questions about their impressions of the book. At the same tune, parents were interviewed about their reactions. Lastly, parents were asked conjoint analysis questions. A schematic of this process is shown in Figure 3.

Figure 3: Focus group process



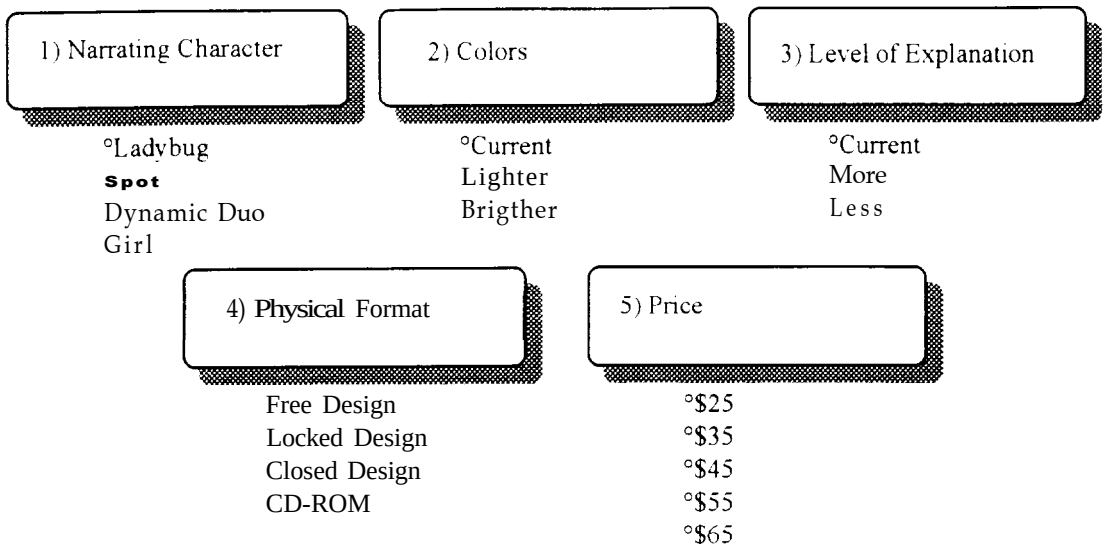
The Role of Conjoint Analysis

The primary function of the conjoint analysis is to obtain quantitative data from subjects about how strongly they like or dislike current and potential features of the product. This data compliments the qualitative data obtained from the open-ended interviews with the parents in the following ways:

- Verifies what people like and do not like
- Provides an indication of how strong these preferences are
- Evaluates how people make tradeoffs between likes and dislikes
- Helps determine how much people will pay for product designs

Based on discussions with Kid Science, we chose five book design attributes to be evaluated via conjoint analysis. Descriptions of these areas and corresponding alternatives are listed in Figure 4. In each case, the first alternative listed is incorporated in the current prototype design, while the rest are specific alternatives under consideration. The descriptions of these alternatives are necessarily vague due to their propriety.

Figure 4: Book design attributes



The Conjoint Analysis Process

The vehicle used to design and evaluate the conjoint questions was Sawtooth Software's ACA computer program. This program allows the user to identify an attribute hierarchy, specify question parameters, and customize computer screen templates to be used to generate and record the answers to the conjoint questions in real time. This method was used to allow subjects to directly input their responses into a computer. Four question areas were used for conjoint questioning. These areas and descriptions of their parameters are listed below.

Rank Order

Subjects were asked to rank the alternatives from 1 (best liked) to n (least liked). for each attribute.

Attribute Importance

Subjects were asked for each attribute to determine its importance in their evaluation of the product. Respondents were asked to consider products which included their most favorite attribute, as well as products which included their least favorite attribute.

Pairwise Comparisons

Subjects were presented with fifteen questions, each depicting a choice between two designs that were very similar except for two attributes. The computer varied the attributes and alternatives involved in the questions based on the respondent's answers to the previous questions so as to optimize the preference information that can be inferred.

Probability of Purchase

The last series of questions involved asking the subjects to rate how likely they would be to purchase various product designs at different price levels.

Our experience with using a computer instead of a pen and paper questionnaire was very positive. Participants were generally able to complete the conjoint questions in 15-20 minutes and liked the computer format. The ACA software also allowed us to ask questions which compared only two different attributes at a tune rather than "full profile", which would have included five attributes at a time. We feel this was a great advantage because it allowed subjects to think more clearly about the tradeoffs they were being asked to make.

Conjoint Analysis Results

The ACA program automatically calculates utilities based on respondents' answers to the computer-generated questions. The method of calculating individual utilities was chosen to be least squares regression (i.e., minimizing the squares of the differences between values). Overall utility values were calculated as the average of individual utility values. The results of the utility analysis are summarized below in Figure 5.

The results provide a strong indication of the validity of the data obtained from ACA from observation of the correlation between scaled utility and scaled rank values (see Appendix C for definitions). The only inconsistency to note is regarding the "Girl" and Dynamic Duo" alternatives under the Narrating Character attribute. In addition, the ACA measure of data reliability, the squared multiple correlation value, is 82 for the data we obtained. According to the ACA manual, this value is well within the norms of reliable conjoint results.

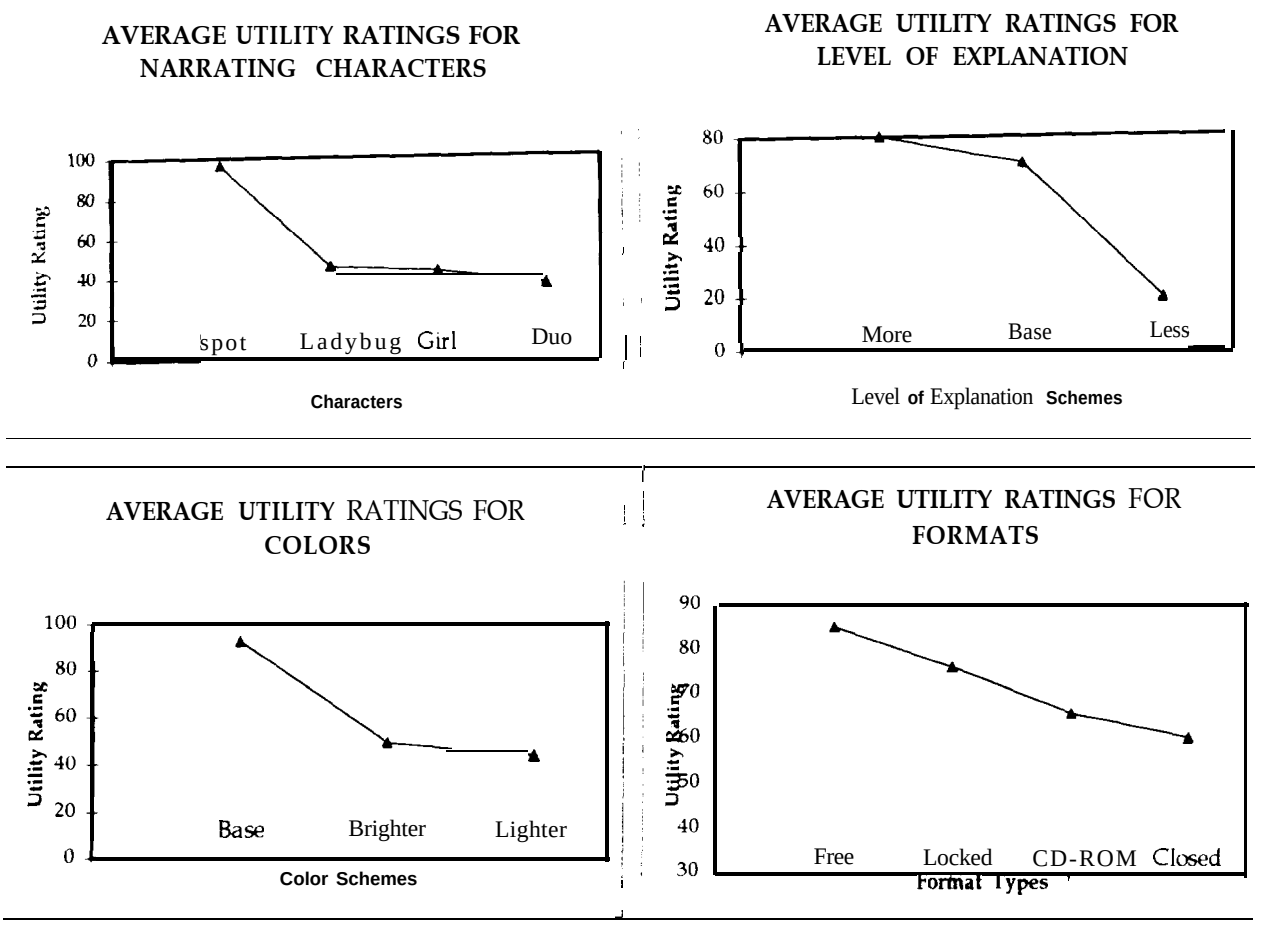
The optimal product design, as inferred from the conjoint results, is as follows.

Optimal Product Design

Character:	Spot
Color:	Base
Explanation:	More
Format:	Free Design

Several likelihood of purchase data points were collected for this product design at different price levels. Refer to Appendix C for the graphs of the results of this data. Note that for prices above the $25 to $35 range, the likelihood's of purchase fall dramatically.

Figure 5: Utility graphs from conjoint analysis



Conjoint Analysis Insights

Conjoint analysis proved to be a worthwhile supplement to the more free-form parent and child interviews that were conducted. Forcing people to think quantitatively about their preferences and willingness to make certain tradeoffs yielded insights which may not have otherwise been obtained. Key insights are summarized as follows.

- The right character and colors are significant to purchase probability

  The highest rated attribute alternatives, besides the lowest price, were in the Character and Colors categories. This observation, along with the fact that the highest rated alternatives in these categories had no close competitors, indicates that the best liked alternatives in these categories provide much value to consumers.

- Although many people liked the Ladybug best, Spot is much better

  A clear design winner based on utility values was Spot as the narrating character. This insight was not readily apparent during the open-ended interview process because many people also preferred the Ladybug. The reason that Spot appears to be a much better choice is that in general the people who like Spot the best did not like the Ladybug nearly as well. Conversely, people who favored the Ladybug the best also liked Spot fairly well.

- The free design, while it may steer some away, is better overall

  Certain people stated in the parent interviews that they strongly preferred the locked design to the free design. In fact, their opinions were stated so strongly that they left the impression that they would not buy the product if it had the free design. Even so, the conjoint analysis reveals the fact that the "silent majority" prefers the free design much more and overshadows the few outspoken champions of the locked design.

- The best pricing strategy may fall slightly under $35

  The Purchase Probability graph illustrates the fact that the number of people who would consider buying the product for over $35 drops dramatically. Many people, though, would be almost as likely to buy the product at $35 as they would at $25.

The Market Diffusion Model and Cost Model

Overview

We developed a modified version of the Bass model which incorporates the effects of three marketing mix variables: price, advertising, and distribution. In addition we developed a joint cost model involving these same variables. Together these two models map a chosen level of advertising, distribution, and price into a projected revenue curve (derived from sales) and a projected cost curve, and thus a projected profit curve. We used these models both to synthesize "non-intuitive strategies" via profit optimization, and to define and assess (sales) parameters of the "intuitive strategies" which feed into the decision model.

Model Descriptions

In order to include the effects of price, advertising, and distribution into our market diffusion model, we began with Frank Bass's original Bass model (Bass 1969), combined the price effects modification of Jain and Rao (Jain and Rao, ***1990)***, the advertising effects modification of Simon and Sebastian (Simon, 1987), and developed our own simple modification for distribution effects. (See Appendix B for complete formulation.)

Price Effects

In essence, the price affects only the eventual probability of purchase parameter, c, in the model. This can be thought of as defining a sales "ceiling". That is, the maximum number of total product sales in the future is the proportion c of the potential market size.

Advertising Effects

Advertising affects the coefficient of innovation (the external influence parameter, p) and the coefficient of imitation (the internal influence, or word of mouth, parameter, q) in the model. These coefficients affect the rate of market diffusion for the product. That is, the greater the coefficient of innovation and the coefficient of imitation, the faster the sales will reach the sales "ceiling".

We established base values of p and q by comparing our product against similar products in the Literature whose p and q had already been estimated. We were able to find a very close product match -- an accelerated teaching program which, like the Kid Science prototype, is an innovative educational product (Lawton and Lawton, 1979). From the range of estimated values of p and q for the accelerated program, we chose the minimum values ($p = 0.0006$ and $q = 0.87$) as our base values, and then established a model in which various forms of advertising augmented the values of p and q, with corresponding costs. (See Appendix B)

We chose ten forms of advertising media: newspapers, radio, TV, teacher magazines, parent magazines, local fanfare (in-store promotions, etc.), intemet, museum exhibits, socially responsible promotions, and freebies to influential individuals. We did extensive research to determine the base costs of each "unit of effort" in each of the different media. For example, one unit of effort in the newspaper medium translates to one inch of advertising without a contract in a weekday paper, which has a cost of approximately $335. (Source SF Examiner) (See Appendix E). We then used management judgment to determine the relative effects of one unit of advertising in each different media on the rate of diffusion transfer. One unit of effort in each medium was then modeled to effect p and q accordingly. That is, each unit of effort caused the product to diffuse faster into the market. The model was calibrated so that maximum advertising in all media would raise p and q just over the maximum estimates given for the accelerated program.

Distribution Effects

We modeled distribution as affecting the total potential market size parameter, M, in the model, the number of people potentially exposed to the product Both the type of distribution channel and the level of aggression in pursuing that channel affect the potential market size. The maximum possible value of M was determined to be approximately 2 million (See Appendix B). If maximum effort in all channels was pursued, then the potential market size was modeled as 2 million. Anything less than maximum effort would result in a potential market size smaller than 2 million (See Appendix B)

While we developed a list of approximately a dozen possible distribution channels in working with the client, we used only three distribution alternatives: mail order, retail, and distributor. We did not feel that all of the more specific alternatives were significantly different enough in terms of cost and market effect to warrant modeling separately. We felt that this level of detail was tactical, rather than strategic.

Again we modeled a "unit of effort" in each distribution channel and estimated a corresponding cost and market exposure. The maximum market exposure of the mail order alternative (with maximum effort) was approximately 1/10 of the total market or nearly 200,000 people; the maximum market exposure of the retail alternative was approximately 7/20 of the total market or 700,000 people; and the maximum market exposure of the distributor alternative was approximately 11/20 of the total market or 1.1 million people. In general there were decreasing marginal returns in market exposure with effort. The costs, on the other hand, were linear in the level of effort, with distributor and mail order costing

approximately the same amount and retail costing about three tunes as much. (See Appendix B for details).

The final figure that is used in the distribution model is an estimate of the percentage of the final sales price that Kid Science will keep as revenue. This, in essence, is a measure of the mark-up involved with each type of distribution channel. For instance, in the case of the distributor, Kid Science will sell each unit to the distributor, the distributor will mark-up the price and sell the unit to retail stores, who in turn will increase the price again for the consumer. On average, the price will be marked up over 230% from the price that Kid Science actually receives from the distributor. This translates to approximately 30% revenue retained per unit by Kid Science, from which Kid Science must pay manufacturing and other costs. The retail route involves higher cost (hiring a sales force paying salary benefits and commission, paying for shipping to each store, etc.) but involves a larger gross margin (estimate of 50%). And finally the mail order route involves fewer costs and a larger gross margin (66%), but reaches a smaller number of consumers.

Model Uses

The market diffusion and cost models are not direct inputs into the decision model. They are used instead to contribute to the background state of information, which along with the conjoint results and management judgment define a set of decision model inputs, Specifically, the diffusion/cost model played the following two roles:

Specify "Intuitive" Strategies

The "intuitive" strategies were initially defined with more or less vague descriptive terms such as "mass diffusion" and "all-out advertising". The diffusion model was used to quantify these terms and enable us to provide a base for parameter assessments for such things as projected sales at the one and two year mark.

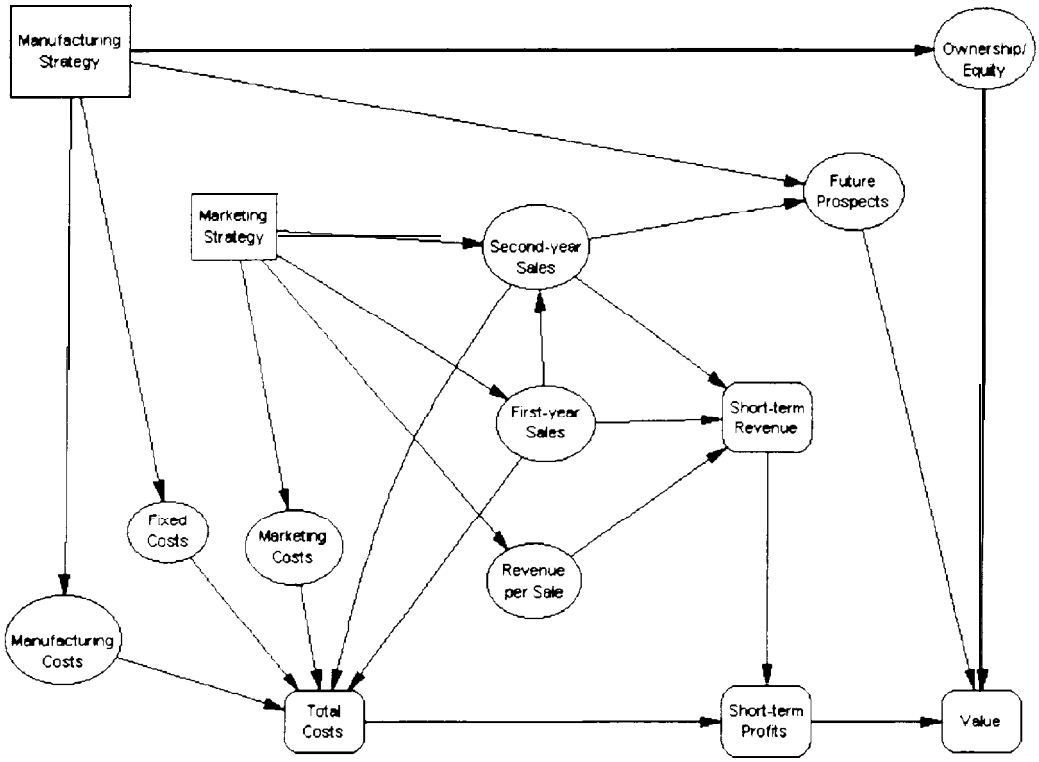
Synthesize "Non-Intuitive" Strategies

We used Excel's solver to optimize "value" at the ten year period in order to synthesize some otherwise "non-intuitive" strategies. Value was defined here to be a weighted sum of cumulative discounted profit at the 10th year and cumulative sales at the 10th year. The weights used were 70% on profit and 30% on sales. This enabled us to get sales figures for the more-or-less vague strategy terms using optimized levels of advertising and distribution.

Decision Model

This section describes the evaluation of the decision **model** developed in the Problem Formulation section. The influence diagram representing Kid Science's decision problem has been reproduced in Figure 6.

Figure 6: Influence diagram representing Kid Science's problem



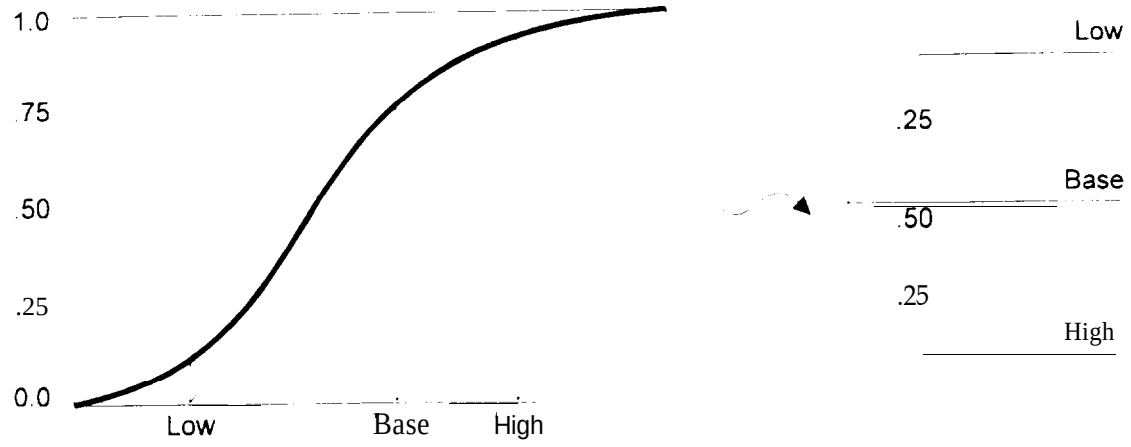
Assessments of Uncertainties

In the decision analytic framework, each uncertainty is associated with a conditional probability distribution representing the decision-maker's beliefs about its outcome. Our project team provided the probability distributions for all uncertainties in the decision model. The assessments are based on our discussions with Kid Science about their beliefs, the results of our conjoint analysis, and our experience with using the new product diffusion model.

For each conditional distribution we defined three values: low, base, and high. The base value corresponds to the mean of the distribution, the low value to the mean of the first quartile of the distribution, and the high value to the mean of the upper quartile of the distribution. This process is depicted in Figure 7. Rather than carefully assessing

continuous conditional distributions for each uncertainty, we assessed the discrete values directly. These values are listed in Appendix F.

Figure 7: Discretizing probability distributions



We quantified the future prospects uncertainty in a slightly different manner. In the Problem Formulation section, we defined four mutually exclusive and collectively exhaustive states for future prospects. In our assessments, we assigned probability mass to each state, given the manufacturing decision and two-year sales. These values are also listed in Appendix F.

Evaluation

We evaluated our decision model using DPL decision analysis software. The strategy with the highest expected value is Test the Waters: *Virtual Corporation*. Strategies incorporating the Virtual Corporation manufacturing alternative were preferred over all others, regardless of marketing strategy. An important insight of our evaluation is that the expected value for each strategy is negative.

Sensitivity Analysis

Our sensitivity analysis confirmed our belief that manufacturing costs are, in general, too high for Kid Science to consider any alternative except *Virtual Corporation*. As a result, investigation of manufacturing costs would be pointless. On the other hand, our analysis indicates that a *Mercedes* strategy may also be effective, and thus more extensive research into marketing costs may prove helpful. The sensitivity analysis also proved that Kid Science's ownership in the company has a negligible effect on value due to the high manufacturing and marketing costs they will be facing.

models were used in conjunctron with our discussions with Kid Science to assess the probability distributions of the uncertainties Kid Science is facing.

Limitations of our analysis

Given our time constraints, we derived partial uncertainty assessments from Kid Science. We extrapolated information from our discussions with them and used output from the new product diffusion model and conjoint analysis to assess the uncertainties in the decision model ourselves. With more time, we would have preferred to refine these assessments with Kid Science as a more active participant. In addition, Kid Science, as a start-up company, is not only faced with a significant number of decisions, but also with the question of what is most important to them in establishing their company. We developed a value model which incorporates other factors, besides profit, that are important to them. However, the value of equity and ownership may be rather vague, and, as a result, our value model could be refined given more discussions with Kid Science.

Future considerations

Our analysis focused on some strategic decisions Kid Science is faced with. However, because the children's toy/book market is quite competitive and because our market diffusion model indicates a very slow sales growth, perhaps Kid Science should investigate their policy decisions, and specifically consider whether or not this company would be a lucrative venture. However, the Bass Model is more effective in predicting the trend in sales growth rather than the quantity of sales and, in this respect, we may assume that although Kid Science may experience losses in the first two years of business, they should expect future sales to grow over time.

CONCLUSIONS

Recommendations

As a result of our analysis, we recommend that Kid Science operate according to the following strategy:

- Operate as a Virtual Corporation. Contract the printing, laminating, cutting, and assembly of the first product with an outside manufacturer.
- Market the product using a Test the Waters strategy. That is, establish a price of approximately $35 for the first product and restrict minimal advertising to a local geographic region.
- Produce a product including the following consumer preferred characteristics:
  - ⇒ gender-neutral (Spot) character
  - ⇒ current colors and format
  - ⇒ more detailed explanation of concepts

We also recommend that Kid Science expend more effort in investigating marketing costs rather than the fixed and variable costs of various manufacturing options.

Summary

Our experience with Kid Science proved to be a valuable one. They are faced with a great number of decisions and a significant portion of our effort was spent framing their decision problem with respect to marketing and manufacturing. Although time restrictions prevented us from also pursuing policy and tactical issues, we believe our analysis will be quite valuable to Kid Science. In addition to presenting our results and providing input to the Kid Science founder's Masters project and Business Plan, we will hand over a computer forecasting tool which will enable Kid Science to evaluate marketing strategies and sales forecasts as their state of information changes over time.

Our model is a detailed decision analysis problem rather than a simple scenario tree. As support to this decision analysis framework, we developed a diffusion model to incorporate the several marketing mix variables discussed earlier. The output of this modified Bass Model, in addition to the results of our conjoint analysis, served as inputs to our state of information rather than as direct explicit inputs to our decision model. These quantitative

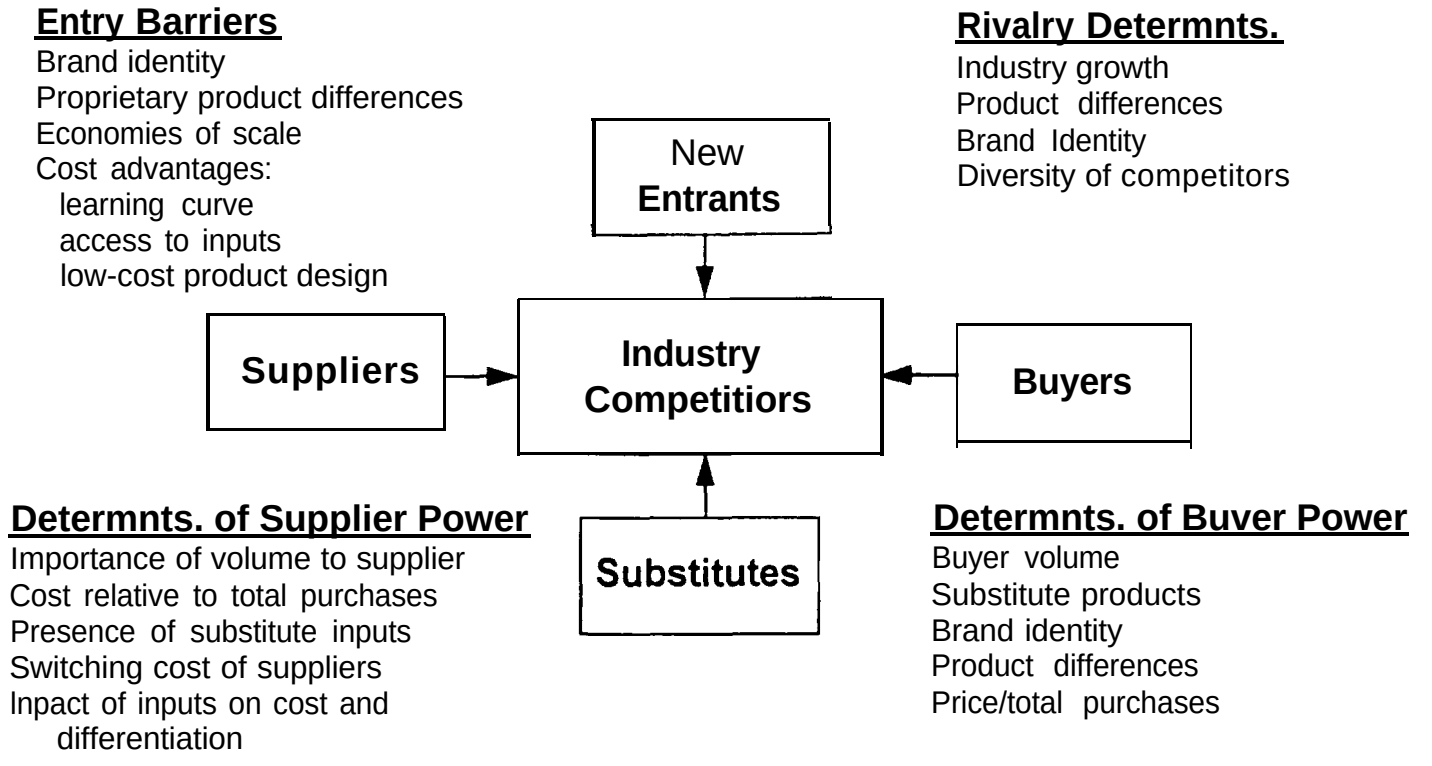
APPENDIX A: PORTER MODEL

Kid Science is in the processes of entering a new marketplace. As a result, the key competitive forces that they are facing deal primarily with barriers to market entry.

The market brand recognition factors heavily into consumer purchase decisions. In entering a market, Kid Science must have an extra edge to overcome its initial lack of brand identity. We believe that product differentiation and advertising will be critical to overcoming this barrier. Kid Science hopes to establish its own niche in the large, varied marketplace of children's toys and books with its unique product features and educational focus. In addition, an effective advertising plan will include targeting consumers with high buying potential and not only mforming them of the existence of the product, but gaining their interest as well.

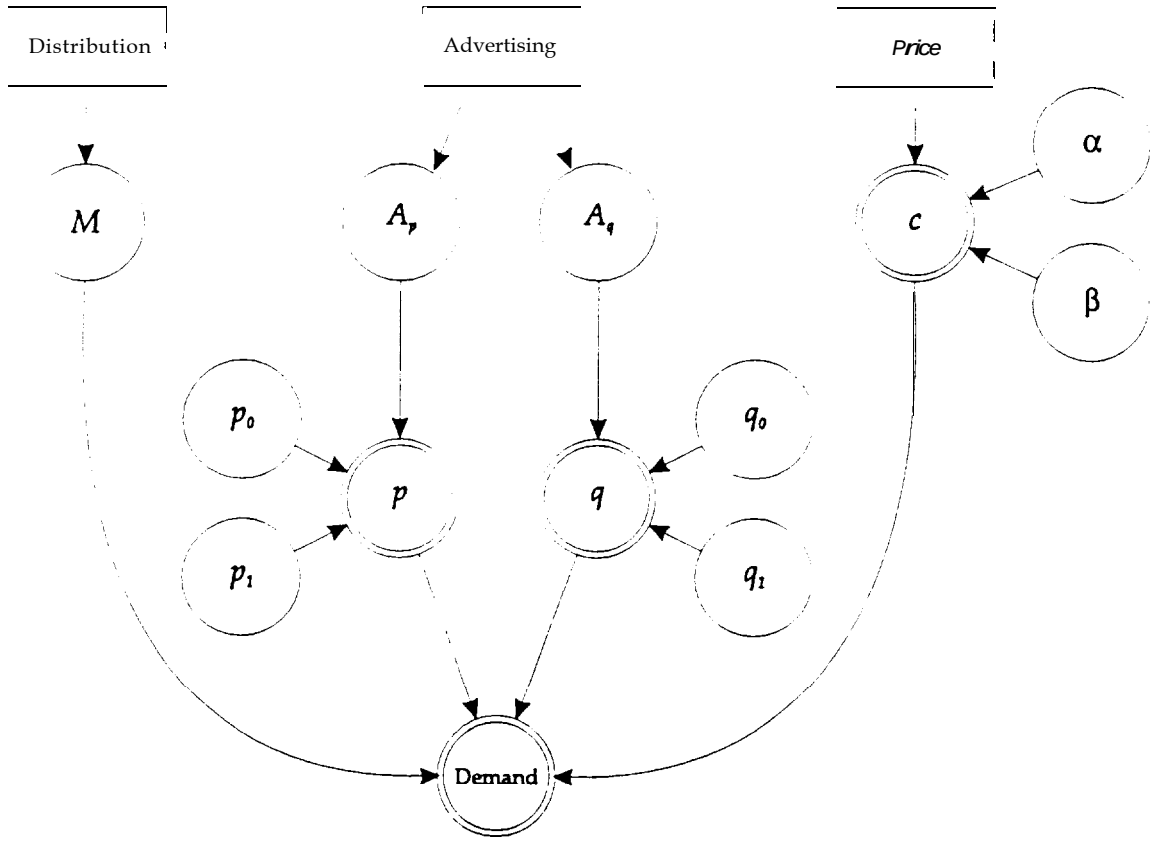
There are a number of cost advantages that existing firms have over entering firms that serve as barriers to entry. Existing firms have already "climbed the learning curve", gained access to inputs, established a low cost production design, and benefit from economies of scale. In order to stay competitive amidst the cost advantages of existing firms, Kid Science will require a unique strategy and economic staying power. Because these factors work against initially creating a cost competitive alternative, we believe that Kid Science must focus on product differentiation (as opposed to producing a cost competitive substitute for existing products) as their primary strategy. In addition, the initial strategy may require a short term loss (or minimal profits) in order to overcome the initial cost barriers to entry and create an environment conducive to future sales.

Figure 8: *Porter model of Kid Science's market*



APPENDIX B: NEW PRODUCT DIFFUSION MODEL

Schematic of new product diffusion model



Key

M	number of people in the potential market who have access to the product
A_p	measure of advertising effort directed towards external influence
A_q	measure of advertising effort directed towards word-of-mouth influence
$u(x)$	consumer utility for product with attributes x
c	probability that someone who has access to the product will eventually purchase the product
a	pricing effects parameter (scaling factor)
b	price elasticity of demand
p	coefficient of external influence
p_0	**base case** level of external influence
p_1	advertising effects parameter (scaling factor)
4	coefficient of internal influence
q_0	base case level of internal influence
q_1	advertising effects parameter (scaling factor)

Assumptions of the Model

Pricing Effects

The effects of price in this model are similar to those proposed by Jain and Rao. Only the probability of eventual adoption (c) is affected by changes in price. As price increases, the probability of eventual adoption decreases. This relationship is given by the following:

$$c(P_t) = \frac{1}{\left(1 + e^{-\alpha} P_t^{-\beta}\right)}$$

The parameters a and β must be estimated once for the entire model. From the conjoint data, we found best fit values of a = 6.3 and β = 2.

Advertising Effects

Our model of the effects of advertising is based on the approach of Simon and Sebastian. In this model, both the coefficient of external influence and the coefficient of internal influence are functions of advertising effort. "Advertising effort" is a measure of the amount of resources committed to advertising. We use the following functions:

$$p = p_0 + p_1 \ln(A_p)$$

$$q = q_0 + q_1 \ln(A_q)$$

The parameters p_0, p_1, q_0, and q_1 must be estimated once for the entire model. By calibrating the values to the range given by Mahajan (Mahajan, 1986) for the accelerated program, we find that p_0, = 0.0006, p_1, =0.0003, q_0, =0.87, and q_1 = 0.045. Each advertising alternative, is associated with a pair of advertising effort measures, Ai_p and Ai_q This allows a single advertising alternative to have different effects on innovators and imitators. The cumulative value of A, and A, then used in the equations for p and q above, is given by the sum of Ai_p and Ai_q for all of the advertising media, i.

Distribution Effects

In this model, the market potential is given by cM, where c is the eventual probability of adoption and M is the total population. We restrict our notion of the "total population" to those consumers who have access to the product (e.g. consumers who shop at retail stores that carry the product). The size of this population changes with the distribution effort exerted by the firm. We model the effects of distribution by estimating the total population with access to the product for each distribution alternative.

The total potential market size was computed to be 2 million. This figure was derived as follows. The product is targeted to 6-11 year olds, particularly those in a household with buying income in excess of $50,000. We assume that a household will buy no more than one of the initial product, even if there are several 6-11 year olds in the household.

There are approximately 22 million 6-11 year olds in the United States today. We assume a conservative estimate of two 6-11 year olds per household, giving 11 million households with a potential of buying one product each. Approximately 28.3% of these households have buying incomes in excess of $50,000. We are thus reduced to a market of 3.1 million in one year, assuming that Kid Science markets in all parts of the country.

Since we do examine sales up to the 10 year mark with the Bass model (though this is not the point of focus in the decision model) we include the growth of the market through the 10th year. We assume the 3.1 million households of interest have children evenly distributed in all the target ages. Thus there are approximately 3.1 million/'/, or roughly 0.45 million children in each of the age categories. Thus approximately 0.45 million children enter the age category in one year, or 4.5 million in 10 years. Add this to the initial 3.1 million and we arrive at a figure of 7.6 million households across the country. Assume that at the maximum effort, we are targeting no more than 25% to 30% of the country, and we arrive at a figure of approximately 2 million potential sales.

The contribution to the potential market size from each of the three distribution channels is modeled as the natural log of the effort expended, where effort can range anywhere from 0 to 100. Thus if the level of effort for marl order, retail, and distributor is given by E_m, E_r, and E_d, respectively, and the potential market size contribution from each of the three is given by M_m, M_r, and M_d, respectively, then the total potential market size is given by:

$$M = M_m + M_r + M_d = a_1 \ln(E_m+1) + a_2 \ln(E_r+1) + a_3 \ln(E_d+1)$$

where a_1, a_2, and a_3 are just coefficients chosen so that the maximum potential for each of the channel is 200,000, 700,000, and 1.2 million respectively. The coefficients themselves are: a_1 = 40,000, a_2 = 160,000, and a_3 = 240,000.

Distribution costs are given as **follows: Mail order and distributor costs are $1 per unit** (shipping and administration) with a nominal fixed cost of $2,000 to cover contractual arrangements. Retail costs are $500 per unit of effort fixed cost to cover a sales person's salary and benefits, and then an addition 5% of the product price as a variable cost per unit.

APPENDIX C: UTILITY DATA FROM CONJOINT ANALYSIS

Table 4: Utility Data Summary

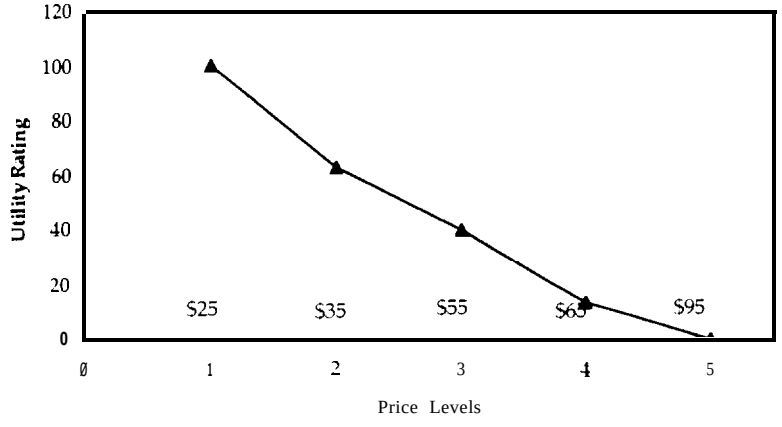
AVERAGE UTILITY MEASUREMENTS				
Attribute	**Level**	**Rank**	**Scaled Utility**	**Scaled Rank**
Character	Spot	1	96	22
Character	Ladybug	2	46	34
Character	Girl	3	43	43
Character	Dynamic Duo	4	36	41
Colors	Base	1	92	17
Colors	Brighter	2	50	32
Colors	Lighter	3	43	35
Explanation	More	1	80	21
Explanation	Base	2	70	24
Explanation	Less	3	20	39
Format	Free Design	1	85	21
Format	Locked Design	2	76	28
Format	CD-ROM	3	66	45
Format	Closed Design	4	60	46
Price	$25	1	100	14
Price	$35	2	63	28
Price	$55	3	40	42
Price	$65	4	14	56
Price	$95	5	0	70

NOTES:

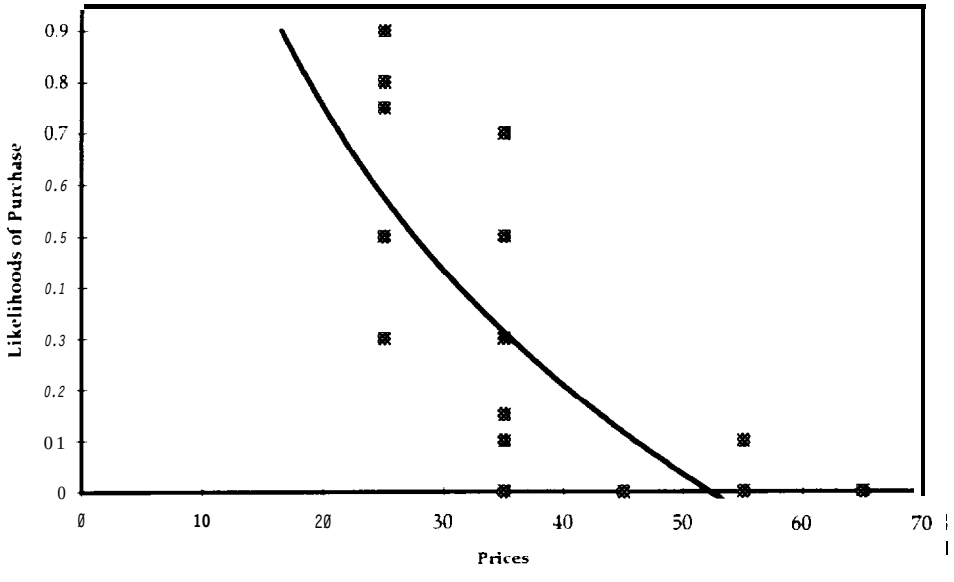
1) Higher utility values are preferable to lower ones.
2) **Rank** is based on best to worst utility values.
3) **Scaled Utility** is calculated by rescaling raw utility scores from 0-100.
4) **Scaled Rank** is calculated by the following procedure:
   - Each respondent was asked to rank their best to least liked alternative for each attribute.
   - Scaled rank is calculated by multiplying the number of people who liked an alternative the best by 1, plus the second-best alternative by 2, and so on.
   - Therefore, the lower the scaled rank, the better liked the alternative was overall.

PRICE UTILITY AND PROBABILITY OF PURCHASE GRAPHS

AVERAGE UTILITY RATINGS FOR PRICES



PURCHASE PROBABILITY DATA FOR THE OPTIMAL UTILITY PRODUCT DESIGN



Prices	Probabilities
25	0.9
25	0.8
25	0.5
25	0.3
25	0.75
25	0.5
25	0.5
35	0.3
35	0.5
35	0.3
35	0.1
35	0.15
35	0
35	0.7
45	0
45	0
45	0
45	0
55	0.1
55	0
65	0

APPENDIX D: STRATEGY TABLE

Marketing Themes	Manufacturing Options	Price	Distribution Channels	Promotion/ Advertising
Mercedes	Vertical Integration	$25	Retail Direct	Dense Regional;
Mass Diffusion	Virtual Corporation	$35	Catalog	All out
Controlled Growth	Value-Chain Partnership	$50	Wholesale Direct	Spot Regional
Test the Waters				Local

APPENDIX E: ADVERTISING COSTS AND DISTRIBUTION FIGURES

Advertising/Promotion Costs

Parent Magazines

Family Circle
- Full page color: $110,000
- Full page color w/ disc.: $80,000
- 1/2 page color: $68,000

Woman's Day
- (5M circulation)
- Full page color: $105,000
- Full page color w/ disc.: $80,000
- 1/2 page color: $64,000

Family Fun
- (< 500,000 circ., bi-monthly, targets ages 3 to 12)
- Full page color: $25,000
- 1/2 page color: $15,000

Good Housekeeping
- Full page color: $120,000 to $130,000
- 1/2 page color: $78,000 to $88,000

Parenting
- (800,000 circ.)
- Full page color: $37,000
- Full page color w/ disc.: $30,000
- 1/2 page color: $24,700

Parents
- (1,750,000 circ.)
- Full page color: $60,000
- 1/2 page color: $37,000

Airline Magazines

Hemisphere - United
- (targets very high income business reader; 500,000 circ.)
- Full page color: $38,880
- 1/3 page color: $17,890
- Full page b/w: $27,210

American Way - American
- (published bi-monthly; 300,000 circ.)
- Full page color: $18,040
- 1/3 page color: $7,757
- Full page b/w: $13,910

Radio

(source: KPIX radio; geographical range includes all of Bay Area; AM and FM frequency; much of specialized weekend programming targets mothers: Gardening, Working Mom, Psychology Talk; weekday programming is more expensive but targets a larger audience; air time may be more expensive around Christmas; advertising prices negotiable; note also that costs of radio advertising vary regionally)

A series of 60 second ads aired over a few weeks ranges from $1,000 to $4,000 depending on whether the ad is aired during weekend or weekday programming, the number of ads aired, and the time of year.

Television

(for spot network, reaching approx. 80% of country)

Produce 30 sec. commercial: $70,000 to $150,000

(for spot network advertising right before Christmas; reaching approx. 80% of country)

Produce 30 sec. commercial: $1,000,000

(cable is cheaper, but ratings are not as good; Nickelodeon reaches 60% of country)

Newspaper

(source: SF Examiner; contract requires 150 in. advertisement and mm. of 1 ad/wk for pre-specified number of weeks)

No contract not Sun.: $335/col. in.
No contract Sun.: $34O/col. in.
W/ contract not Sun.: $313/col. in.
W/ contract Sun.: $318/col in.

Internet

$20,000 to put facing on intemet + monthly fee

Fanfare

At discretion of Kid Science

Promotions/donations

At discretion of Kid Science

Distribution

Catalog/Mail Order

(Source: Sharper Image annual report)
Total # catalogs mailed in U.S. in 1995: 31,522,000

"Gadget Stores"

(Source: Sharper Image annual report)

Total # stores in CA (1994):	17
Total # stores in CN:	2
Total # stores in VA:	1
Total # stores in D.C.:	2
	22 stores total

Assume approximately 30 people enter a store in a day -----> 10,200 people/yr/store

224,400 people/yr/store chain

Retail Book Stores

(Source: Crown Books annual report)

Total # stores in CA (1992):	129
Total # stores in D.C:	61
	190 stores total

Assume approximately 50 people enter a store in a day -----> 17,000 people/yr/store

3,230,000 people/yr/book store chain

Retail Toy Stores

(Source: Toys R Us annual report)

Total # stores in CA:	74
Total # stores in VA:	17
	91 stores total

Assume approximately 200 people enter a store/day -----> 68,000 people/yr/store

6,188,000 people/ yr/ large toy store chain

Public Schools

(Source: National Center for Education Statistics)

Enrollment in CA public elementary schools:	3rd grade:	424,961 stud.
	4th grade:	418,418
	5th grade:	410,701
	6th grade:	399,776
	7th grade:	388,439
Enrollment in VA public elementary schools:	3rd grade:	81,508
	4th grade:	79,821
	5th grade:	79,538
	6th grade:	79,450
	7th grade:	79,342
	Public School total stud.	2,441,954
	Public School total teachers (assume 1 teacher/40 students)	61,048

Private Schools

(Source: National Center for Education Statistics)

Enrollment in CA private elementary schools:	613,068 students
	37,861 teachers

APPENDIX F: DECISION MODEL ASSESSMENTS

Values

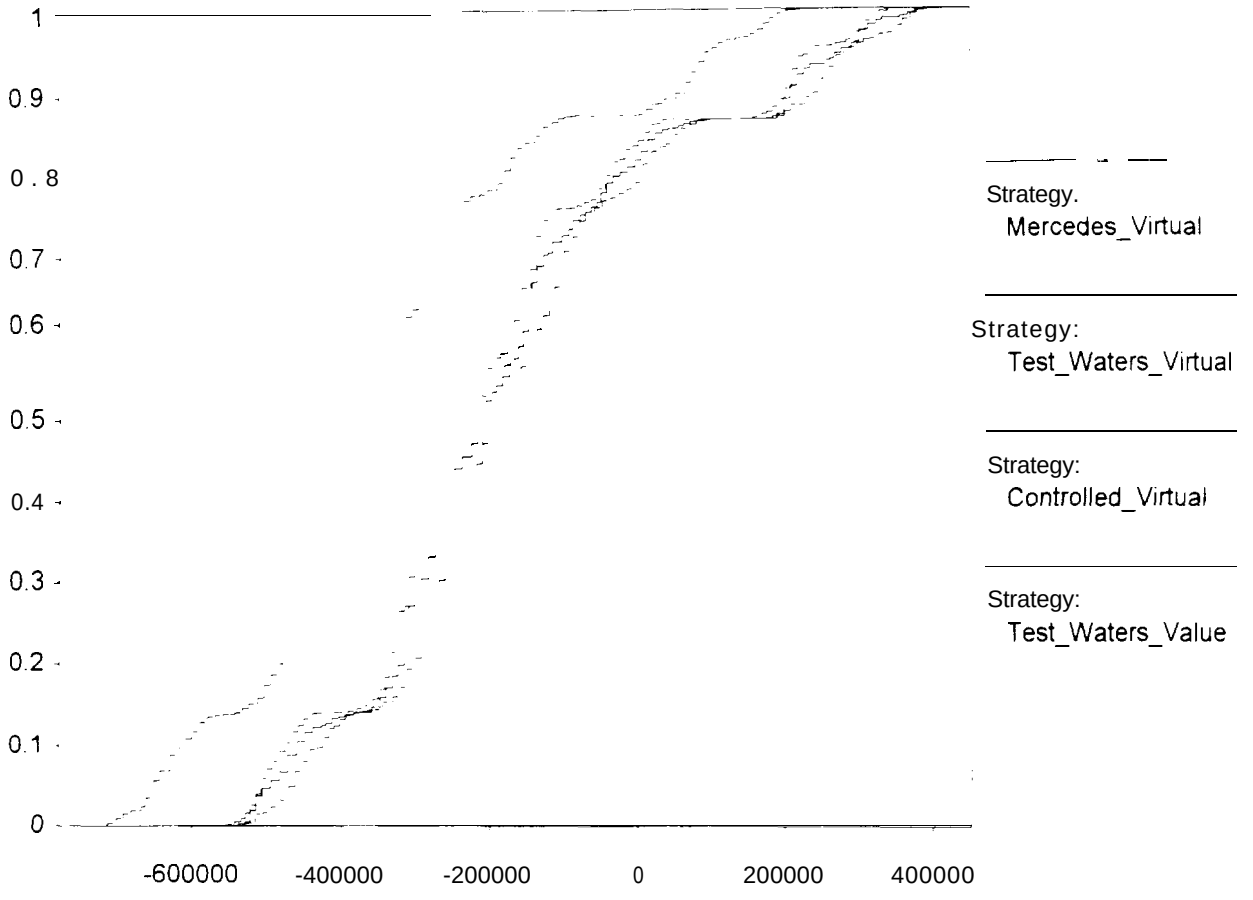
Ownership	*Manufacturing Strategy*		*Low*	**Base**	*High*
	Vertical		*0.5*	**0** 65	*0 75*
	Virtual		*015*	0.2	*0.4*
	Value-chain		*0 25*	0.35	*055*
Marketing Costs	*Marketing Strategy*		**Low**	Base	*High*
	Mercedes		32000	60000	*80000*
	Mass Diffusion		400000	600000	*800000*
	Controlled		60000	140000	*200000*
	Test the Waters		20000	32000	*48000*
Manufacturing Costs	*Manufacturing Strategy*		*Low*	Base	*High*
	Vertical		6	9	*15*
	Virtual		15	18	*35*
	Value-chain		12	15	*25*
Fixed Costs	*Manufacturing Strategy*		*Low*	Base	*High*
	Vertical		900000	1100000	1400000
	Virtual		100000	200000	400000
	Value-chain		300000	400000	*600000*
First Year Sales	*Marketing Strategy*		*Low*	*Base*	*High*
	Mercedes		*50*	*200*	300
	Mass Diffusion		400	700	1400
	Controlled		400	*550*	650
	Test the Waters		*130*	*200*	*400*
Second Year Sales	*Marketing Strategy*	*First Year Sales*	*Low*	*Base*	*High*
	Mercedes	High	*500*	*550*	*600*
	Mercedes	Base	*400*	*500*	*575*
	Mercedes	Low	*20*	*180*	*210*
	Mass Diffusion	High	*500*	*1500*	*3500*
	Mass Diffusion	Base	150	1200	*2200*
	Mass Diffusion	Low	20	400	*600*
	Controlled	High	1100	1500	*2200*
	Controlled	Base	1000	1300	*1700*
	Controlled	Low	600	750	*1000*
	Test the Waters	High	700	800	*1200*
	Test the Waters	Base	450	600	*750*
	Test the Waters	Low	20	150	*230*

Future Prospects	*Blockbuster*	*Hopeful*	*Dismal*	*Bust*
	500000	*150000*	25000	-20000

Probabilities

Future Prospects	*Manufacturing Strategy*	*Second Year Sales*	*Blockbuster*	*Hopeful*	*Dismal*	*Bust*
	Vertical	High	*010*	*0.45*	*0.25*	*0 20*
	Vertical	Base	*005*	*0.30*	*0.40*	*025*
	Vertical	Low	*0.02*	*0.03*	*0.05*	*0.90*
	Virtual	High	*0 27*	*0.33*	*0 25*	015
	Virtual	Base	*0.20*	*0.30*	*0.30*	*0.20*
	Virtual	Low	*0.05*	*0.10*	*015*	*070*
	Value-chain	High	*0 20*	*0.38*	*0.24*	*0.18*
	Value-chain	Base	*0.225*	*0.325*	*0.30*	*015*
	Value-chain	Low	*0.04*	*0.06*	*010*	*0 80*

APPENDIX G: CUMULATIVE DISTRIBUTIONS OF EXPECTED VALUE



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