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# Using Demonstration to Promote Information Products

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## Motivation: Personal History

- Year 2001, I needed a friendly editor  $\Rightarrow$  **Information Products**
- Searched the Internet for editors, many available  $\Rightarrow$  **Plenty**
- Limited info on editor capabilities  $\Rightarrow$  **Lack of Information**
- Evaluate editors by using them  $\Rightarrow$  **Demonstration Provides Info**
- Buy or Not depends on the info gathered during demo.

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## Motivation: Business Perspective

- Incremental cost of producing information products
  - Ignorable: Cost of copying the source code of an editor=0
- Cost of distributing information products
  - Ignorable: Cost of sending the source code over the Internet=0
- Profit = Revenue - Cost = Revenue
- Businesses want to sell as many as possible
  - Not always the case in other industries
- Customers prefer to try information products. AOL manager '02:  
“trial offers are worthwhile because nearly 75% stay on as full-paying members.”
- Businesses ask: How to structure demonstrations to sell more ?

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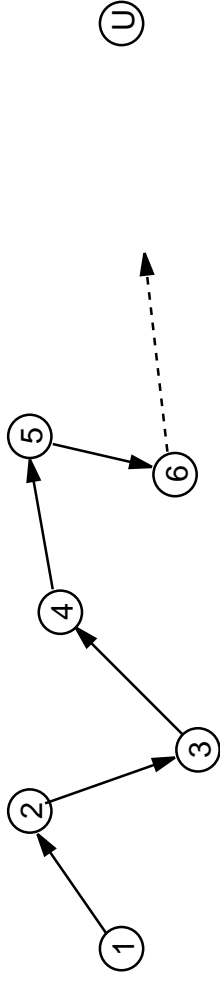
## Literature Review

- Product evaluation relates to new info gathering, updating info, perception formation
  - Pennings & Harianto'92: Knowledge of a product grows during demonstration
  - Bettman et al.'98: Customers have dynamic preferences not stationary
  - Meyer & Sathi'85: Beliefs are a combination of initial and observed beliefs
  - Roberts & Urban'88: Offset the utility of a product to account for uncertainty
  - Muthukrishnan & Kardes'01: Product trial is a necessary tool to develop an opinion
- Product attributes and learning
  - Heiman & Muller'96: Discovery of Information product attributes take substantial time
  - Kempf & Smith'98: Product trials have powerful influence on brand evaluation

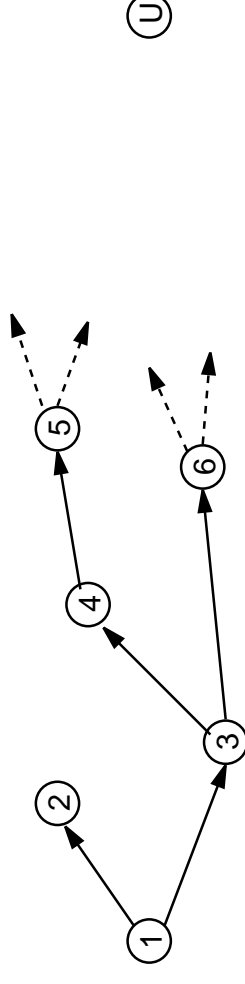
# Information Product is a Network of Modules (Features)



Unordered features



Features in a full (chain) order



Features in a partial (precedence) order

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## Features and Values

$V$  is a (feature) value function assigning monetary value to features and satisfying:

1. Positivity:  $V(\emptyset) = 0$  and  $V(C_1) \leq V(C_2)$  if  $C_1 \subseteq C_2$ .

No feature with negative value. If a feature is completely useless, it has zero value.

2. Additivity:  $V(C) = \sum_{k \in C} V(\{k\})$  for all  $C$ .

Independent feature values. Fails if there is synergy or duplicity among features:

Synergy example:

Value(Editor) + Value(E-mail tool) < Value(Editor that e-mails)

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## Customer Wishes

Not all features are useful to customer.

$S$ : the set of features functioning according to customers' specifications.

Value of feature  $i$  to a customer is random variable from a business' point of view.  $Y_i$  are iid with  $E(Y_i) = 1$ ,  $StDev(Y_i) = \sigma$ , why stochastic, why identical?

$$\left\{ \begin{array}{ll} Y_i & \text{with probability } p \quad \text{i.e. feature } i \text{ is good} \\ 0 & \text{with probability } 1 - p \quad \text{i.e. feature } i \text{ is bad} \end{array} \right\}$$

Before customers try all features,  $S$  is random to them. After all features are tried the value of the product is  $V(S)$ .

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## Vendors Use Demonstration Strategies because

- If all the features are available to customer with the demo, customer may use demo only without buying the product
  - Product trials take time, vendors want to sell products quickly
1. Version strategy: Give away only  $N$  features to customer for forever. One can read 1-2 chapters of a book at Amazon.com.
  2. Phase strategy: Give all the features for only  $T$  time (days). AOL gives away 1000 hours of membership with demo.
  3. Combined strategy: Given only  $N$  features for  $T$  time. Game Commander gives away a limited version of the software for only 30 days.

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## Version Strategy with $N$ Features

The value of product after evaluating  $N$  features:

$$V_N = \sum_{i=1}^{Bin(N,p)} Y_i$$

Special cases:

Case 1. When many features are included in the demo version, i.e.,  $N$  is large, Normal approximation:

$$V_N^1 = \mathcal{N}(Np, N(p\sigma^2 + p - p^2))$$

Case 2. If vendors know the value customers attach to each feature with certainty, then  $Y_i = 1$  for all  $i$  after scaling values by their expected value.

$$V_N^2 = Bin(N, p)$$

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## Phase Strategy with $T$ Time

Suppose an average customer learns according to Poisson process at the rate of  $\lambda$ : At  $t$ ,  $Po(p\lambda t)$  features have been learned. The value of the product at  $t$

$$V(T) = V_{Po(\lambda T)} = \sum_{i=1}^{Bin(Po(\lambda T), p)} Y_i = \sum_{i=1}^{Po(p\lambda T)} Y_i$$

Case 1.  $T$  is large, Normal approximation:

$$V^1(T) = \lambda T p + \sqrt{\lambda T p(\sigma^2 + 1)} \cdot z$$

where  $z$  is the standard Normal variable

Case 2. Certain feature values

$$V^2(T) = Po(p\lambda T)$$

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## Equivalence of Strategies under $N = \lambda T$

Marketing strategies of demo phase of  $T$  and demo version of  $N$  features yield approximately the same random product value at the end of the demo if  $N = \lambda T$  and  $N$  is sufficiently large.

Strategies are not equivalent if offered together and if  $N = \lambda T$ . Otherwise, fast learners choose phase strategy and learn more than  $N$ . No vendor offers strategies together.

Offering strategies together provides self-customization of the demo process.

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## Profits under the Version Strategy with $N$ Features

Instead of profit from a population, consider equivalently profit from an average customer:  $\text{Profit}(\text{Price}, N) = \text{Price} \times \text{Prob}(\text{Sales happen})$

Justification price = Constant  $\times$  Price. If constant = 50%, customers justify the purchase at the 50% of the price. Offset the price to account for features not in the Demo Version.

$$\text{Profit}(\text{Price}, N) = (\text{Justification price} / \text{Constant}) \times$$

$$\text{Prob}(\text{Value of } N \text{ features} \geq \text{justification price and } \dots)$$

$$\text{Constant} \times \text{Profit}(\text{Justification price}, N) = (\text{Justification price}) \times$$

$$\text{Prob}(\text{Value of } N \text{ features} \geq \text{justification price and } \dots)$$

$$\text{Profit}(c, N) = \Pi(c, N) = c \text{Prob}(V_N \geq c \text{ and } \dots)$$

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## Profits under the Version Strategy

$$\text{Profit}(c, N) = \Pi(c, N) = c \text{Prob}(V_N \geq c \text{ and } \dots)$$

No sales if the demo version itself satisfies the needs of the customer.

$R$ : Maximum value of the demo product that does not meet the needs of customers, random variable.

$$\text{Profit}(c, N) = \Pi(c, N) = c \text{Prob}(c \leq V_N \leq R)$$

Data requirements:

- Feature values  $Y_i$
- The relationship between price and the justification price
- Customer requirements  $R$

Need surveys.

## Unimodality Properties for Version Strategy Profits

$\Pi(c, N)$ with Normal Approx	unimodal in	$c$	if $R$ is DFR or deterministic
-	-	$N$	if $R$ is deterministic
$\Pi(c, N)$ with constant $Y_i$	unimodal in	$c$	<b>and</b> coef.of.var( $Y_i$ ) $\leq \sqrt{1 + pN}$ if $R$ is DFR or deterministic
-	-	$N$	if $R$ is deterministic

1. DFR (IFR)=Decreasing (Increasing) failure rate ( $=\frac{f(t)}{1-F(t)}$ )
2.  $Y_i$  was normalized by its mean, so coef.of.var( $Y_i$ ) should be about 1  
 $\leq \sqrt{1 + pN}$
3. Overlooking at the condition in 2., unimodality conditions are the same for Normal approx and constant  $Y_i$
4. If customer requirements  $R$  are known, virtually no conditions necessary

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## Optimality Conditions for Constant $Y_i$ by Marginal Analysis Under Version Strategy

For  $c$  :

$$Prob(X_N(p) = c)Prob(R \geq c) = \sum_{i=c}^N Prob(X_N(p) = i)Prob(R \geq i)$$

Marginal cost of increasing  $c$  = Marginal revenue of increasing  $c$

For  $N$  :

$$(cp)Prob(X_N(p) = r) = (cp)Prob(X_N(p) = c - 1)$$

Marginal cost of increasing  $N$  = Marginal revenue of increasing  $N$

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## Profits under the Phase Strategy

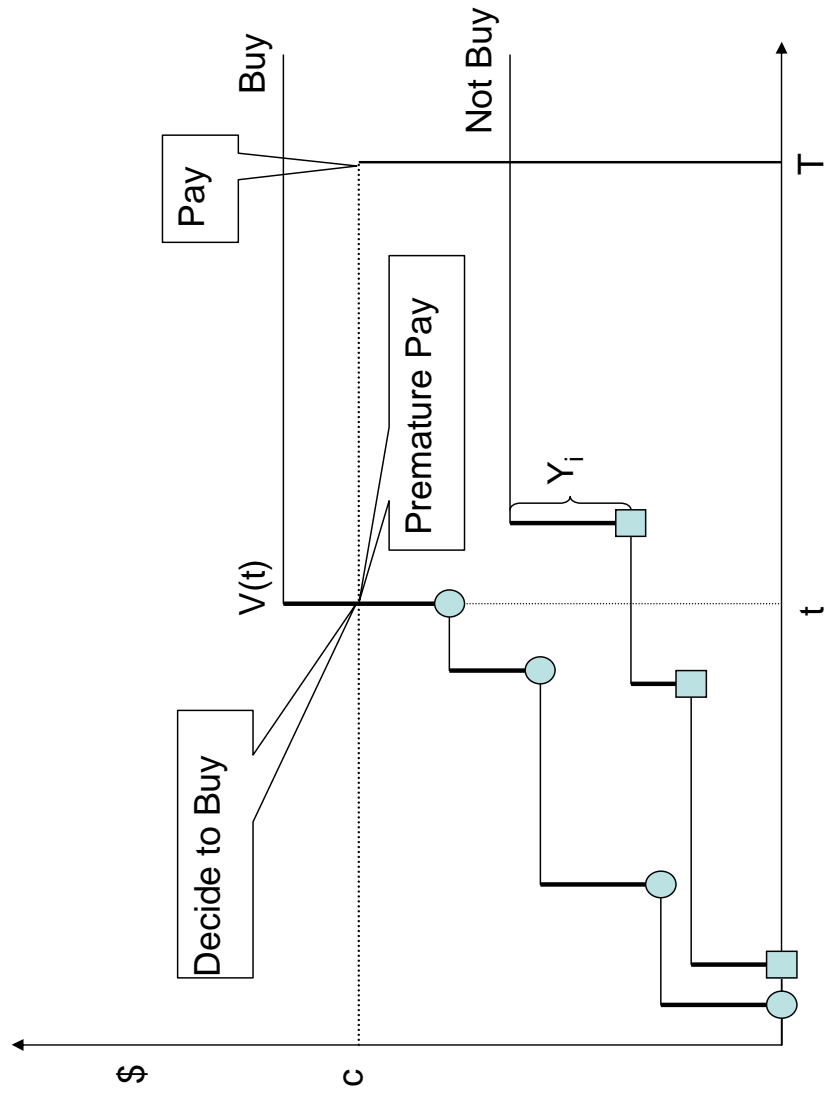
$$\text{Profit}(\text{Justification Price}, T) = \text{Justification Price} \times \text{Prob}(\text{Sales happen}) \\ \times \text{Discounting factor}$$

Since a product cannot be kept forever, it will be bought if Value at  $T \geq$  Justification Price.

Customers decide to buy at  $t \in [0, T]$  but pay at  $T$  so that they keep the cash in their pocket. Discounting factor =  $\exp(-\alpha T)$ .

$$\text{Profit}(c, T) = \Pi(c, T) = c \exp(-\alpha T) \text{Prob}(V(T) \geq c)$$

# Product Value with Phase Strategy : With Premature pay $T \Rightarrow \infty$



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## Discounting Because of Competition

- Suppose that customers evaluate other products (1,2,3, . . . ) simultaneously, besides ours
- Product  $i$  is bought if its value surpasses justification price before  $T$
- If this justification crossing times are exponential with rate  $\alpha_i$ , then the earliest time has rate  $\sum_i \alpha_i$ .
- Our product is bought, if the earliest justification time of all other products is greater than  $T$ . This happens with probability  $\exp(-\alpha T)$ .

## Unimodality Properties for Phase Strategy Profits

$\Pi(c, T)$  with Normal Approx or with constant  $Y_i$  unimodal in  $c$  and  $T$

For  $c : c \, d\text{Prob}(V(T) \leq c) = \text{Prob}(V(T) \geq c)$

Marginal cost of increasing  $c =$  Marginal revenue of increasing  $c$

For  $T : (c) \, \alpha \text{Prob}(\tau_c \leq T) = (c) \, d\text{Prob}(\tau_c \leq T)$

Marginal cost of increasing  $T =$  Marginal revenue of increasing  $T$

where  $\tau_c$  is the time the value surpasses the justification price  $c$ .

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## Optimality Properties for Phase Strategy Profits Under Constant Feature Values

To maximize the profits when  $Y_i$  are known and constant, choose optimal phase length as the reciprocal of the discount rate. Phase length is independent of feature learning rate.

- Optimal justification price increases with learning rate because fast learners can justify higher prices.
- Optimal justification price decreases with discount/competition rate because competition draws prices down.

Beware fast learners can learn about another product fast. Then not clear if the optimal price should move up or down.

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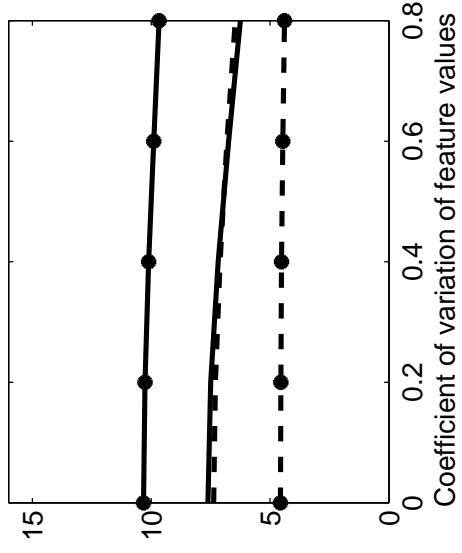
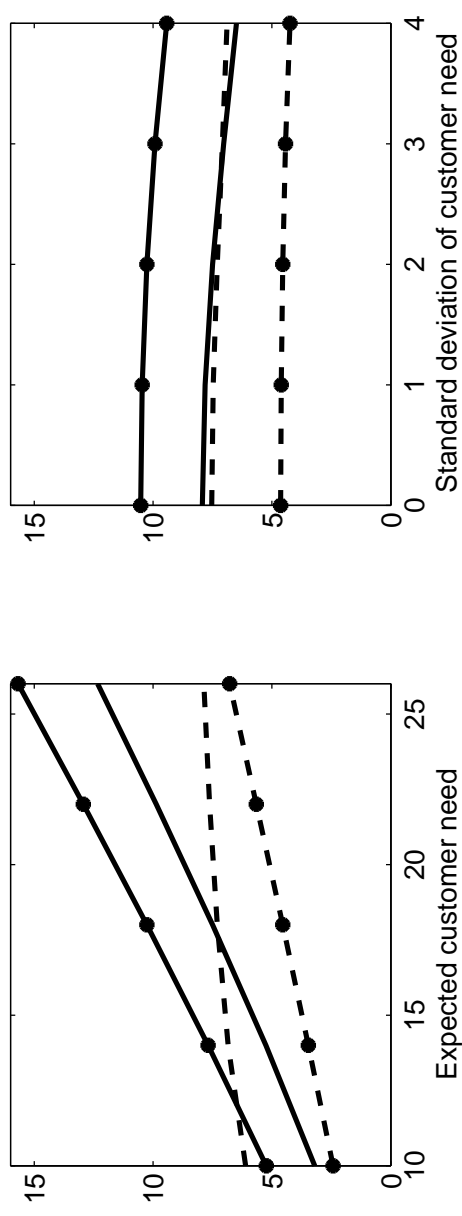
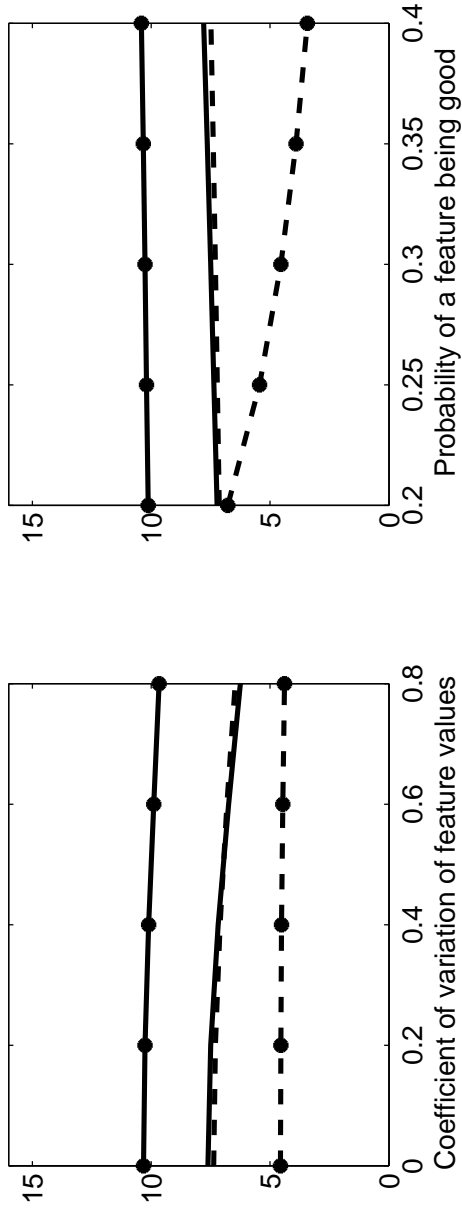
## Data for Experiments

- Each feature is good with 30% probability
- Standard deviation of feature values 0.2
- For Version strategy

$$\text{Customer requirements} = \left\{ \begin{array}{ll} 16 & \text{with probability } 0.5 \\ 20 & \text{with probability } 0.5 \end{array} \right\}$$

- For Phase Strategy
  - Learning rate 10 features per month on the average
  - Discount/competition rate drops the value of \$1 to \$0.75 in a month

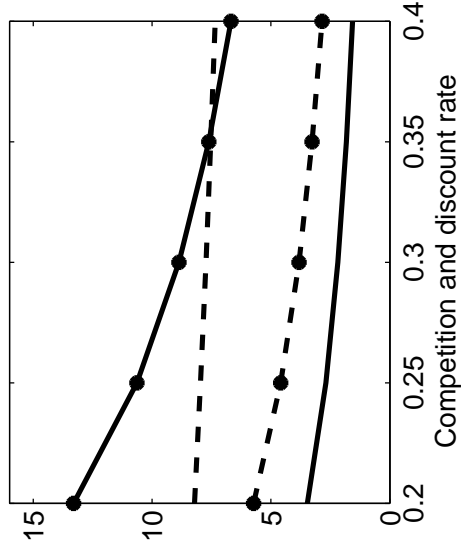
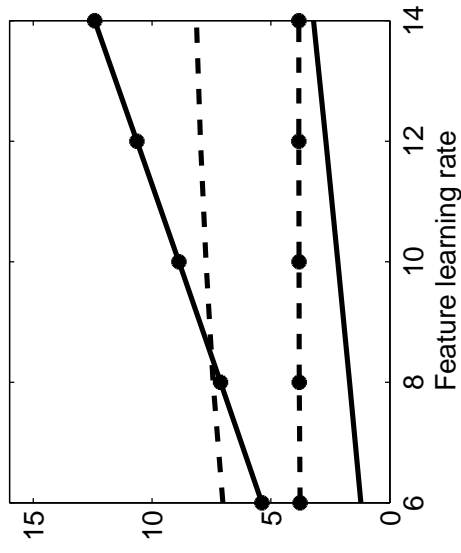
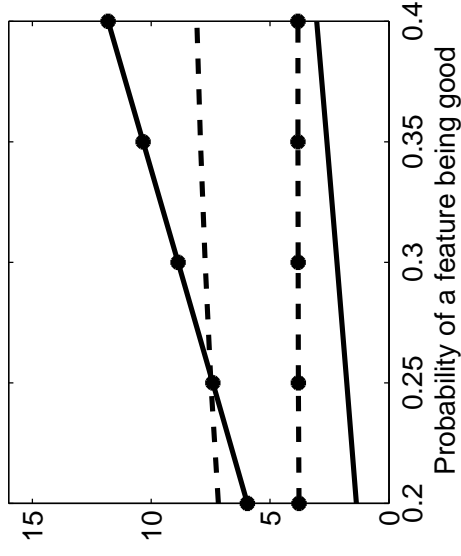
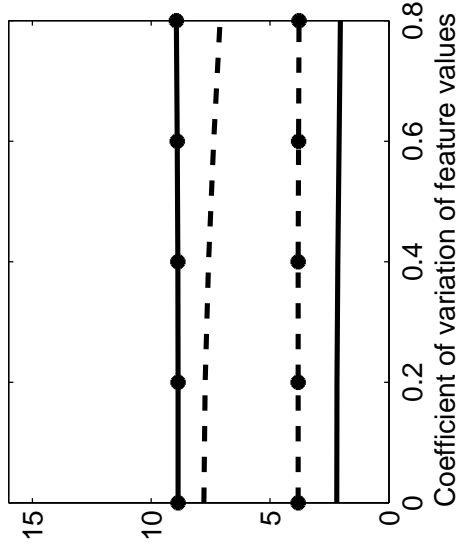
# Experimenting with Version Strategy



II (—),  $10 \times$  Purchase Probability (---), Justification Price (●—) and  $N/10$  (●--●).

- Uncertainty in feature values is not significant. True for Phase strategy also.
- Optimal number of features drop with the probability of being a good feature. Other measures stable. Prepare smaller demo versions if features match customer needs.
- Customers who need more will buy if product price is justified. Increase prices for those customers. Find creative uses of the product.
- Variable customer needs make adjustment of parameters hard, profits drop. Customize demo to customer segments so that variability in each segment is small.

# Experimenting with Phase Strategy



II (—),  $10 \times$  Purchase Probability (---), Justification Price (●---●) and  $T$  (●---●).

- Consider the good feature learning rate  $\lambda p$  of good features. Profits and prices go up with this rate. Vendors can charge more if they match customer wishes or if the customer can quickly appreciate the product. Increase the demo length, it worths to wait for customers to learn.
- When discount rates are high (e.g. high competition), shorten the demo length to limit the time window of vulnerability to competition. Also decrease the price to attract customers.

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## Conclusion / Future Research

- Developed a structured model to study trade offs in Pricing, the extent of Demo Version, the length of Demo Phase
- Established equivalency of strategies in terms of product value at the end of demo
- Established uniqueness of optimal parameters under some conditions
- Panicking customer at the end of the demo
- Positive initial product value with negative feature values due to disappointments
- An explicit model of competition