

## Integrating Public Health & Computer Science Theoretical Perspectives for Developing Tailored Health Messages

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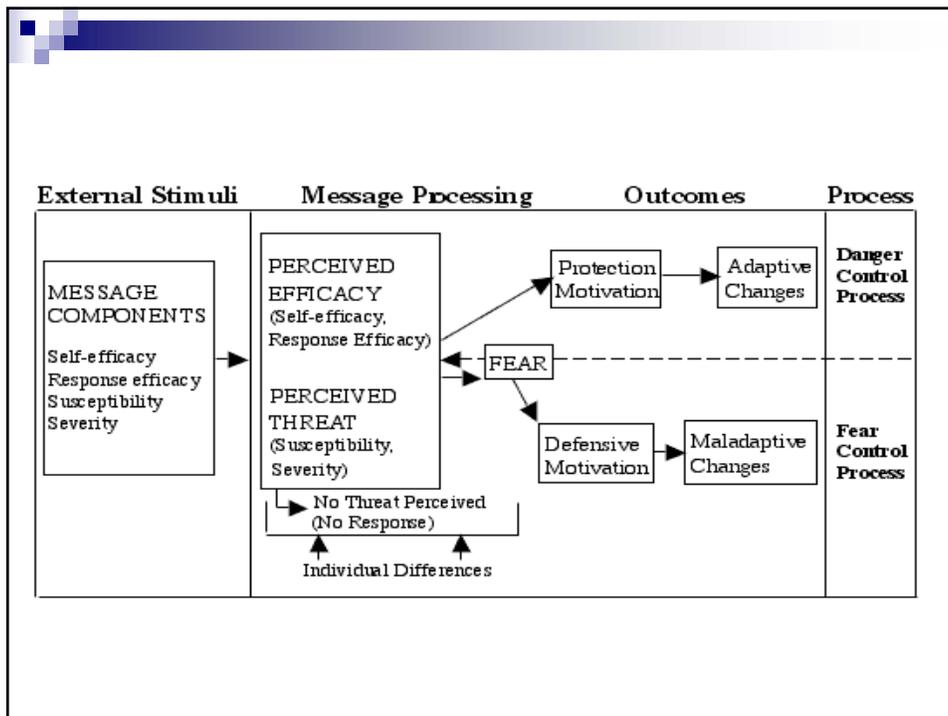


### Focus of Research

- **The fear appeal** - most common persuasive message used to change health behavior.
- **Fear appeals** are persuasive messages that emphasize the harmful physical or social consequences of failing to comply with message recommendations.

# Components of Fear Appeals

- Perceptions of risks are a well-established factor associated with preventive health behaviors.
- Hundreds of studies have examined perceptions of risk -many of those studies support the Extended Parallel Process Model (EPPM)
- Provides a strong rationale to explain why intensity of risk perceptions is not a good predictor of adoption of recommendations and teaches us that risk perceptions must be considered in relation to self-efficacy and response efficacy.



## Tailored Messages

- In recent years, a growing number of investigations have been focused on tailoring messages to individualize messages designed to influence these two components:
  - perceptions of severity and susceptibility (threat)
  - perceptions of self-efficacy and response efficacy necessary for action to be preformed.
- Individualizes:
  - personal susceptibility to preventable diseases,
  - the seriousness of these diseases, and
  - perceptions of self-efficacy and
  - response efficacy
  - in a way that messages communicated generically cannot.

## Tailored messages

- Messages designed to reach a specific person, based on characteristics that are unique to that person, related to an outcome of interest, and derived from an individual assessment.

## Effectiveness of stand alone messages

- Range of health related behaviors- diet, exercise, smoking cessation, weight reduction, mammography, prostate cancer screening, hormone replacement therapy and multiple risk behaviors
- Mounting number of studies of tailored communications have been published
- Reviews do not unambiguously demonstrate the effectiveness of short stand-alone tailored messages

## To explain results

- Investigators, primarily from the discipline and thematic perspectives of public health, looked at curriculum, tailoring depth, amount of existing content, print and quality.
- They neglected, however, to consider how the technological methods employed, as well as the theoretical frameworks upon which these methods are based could have affected both the effectiveness and persuasiveness of the messages generated.

- We examine current methods used to develop tailoring systems employed by both public health and computer science.
- A review of these approaches provides the rationale for integrating the theoretical perspectives, thematic views and experiences from both public health and computer science communities.
- It is based on this review that we propose our methods for developing a new type of tailoring system, an authoring tool to assist health practitioners (message authors) construct persuasive health messages more effectively.

## **The Public Health (PH) Approach to Tailoring**

- (1) Analyzing the problem to be addressed and understanding its determinants
- (2) Developing an assessment tool to measure a person's status on these determinants
- (3) Creating tailored messages that address individual variation of determinants of the problem
- (4) Developing algorithms and a computer program that link responses from the assessment into specific tailored messages
- (5) Creating the final health communication

## Approaches to Tailoring in Computer Science

- Most of these projects have built their systems using Natural Language Generation (NLG) methods
- The basic idea in most of these systems is: to represent explicitly information about the patient (as a 'user model'); to represent general rules about communication, such as "use simple language if patient has low educational level"; and to automatically 'generate' text from some database of health related information, given the rules and user model.

## Challenging Requirements

- The developer of a tailoring system, using the PH approach or the computer (NLG) approach, faces two challenging requirements:
  - acquire the expert knowledge needed to inform the content.
  - assemble the content into a structured health communication document that is coherent, cohesive and effectively persuasive.

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- PH has employed the most obvious method of acquiring expert knowledge for message content by directly asking experts to write it.
  
  - The experts (e.g., health educators, behavioral scientists, health communication specialists etc.) write the content used for tailoring informed by the socio-cognitive theories/models.

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- Some qualitative work is beginning to emerge that examines the degree to which theoretical knowledge is integrated in persuasive health communications
    - Kline found that breast self-examination pamphlets published by national organizations (National Cancer Institute, American Cancer Society) emphasized severity and susceptibility, but did not have adequate levels of response efficacy or self-efficacy (only two of the four components were addressed).
  
    - A study conducted along the Trans-Africa highway, HIV/AIDS prevention messages contained adequate levels of severity and susceptibility, but were weak on response and especially self-efficacy messages

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- Beyond acquiring knowledge to inform the content of the message, a second knowledge source necessary is that which could guide the structure of the content i.e. chunks of text into a structured and cohesive document

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- Public health researchers, while interested in the *empirical* task of explaining and predicting how persuasive arguments work to alter health behavior, have not evaluated the logical structure that operates to make the argument persuasive despite the empirical evidence to suggest that a logical component is involved.

- Persuasive health messages do work, at least partly, because the respondent is capable of logic, persuaded by the argument that:
- a) there is a real dichotomy and b) if he wants to avoid the dangerous outcome (threat to health), he must do the other thing (recommended by the argument).

- While this structuring appears to be a critical function of the persuasive health argument, the logical structure that operates to make the argument persuasive has not been systematically studied.
- There are any numbers of ways the threat and action components can be organized within a persuasive message.
- Unfortunately there is very little empirical evidence regarding the effectiveness of the various organizational patterns.

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- In order to guide the structure of these components and the authored chunks of text into a communication, one needs also a theory that would describe how messages could be put together in a coherent sequence and explains why certain multi-argument structures are more persuasive than others.
  - While such theories are not considered in the PH five-step tailoring process, they have been prominent to the tailoring process employed among computer science researchers.

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- Computational tailoring systems have given prominent attention to argumentation theories.
  - Mainly, the interest is on the rhetorical structure of arguments, and as a consequence, in the structure of rhetorical argumentative discourse.

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- Several researchers have attempted to improve the construction of persuasive argument through the use of formal representations.
  - Stephen Toulmin pioneered this direction (1958) creating a model of argumentation with a notation for depicting arguments graphically.

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- Others (Perelman) developed this approach in 1969, resulting in what has been termed the New Rhetoric, which provide a comprehensive typology of argument schemes.
  - Rhetorical structure theory (RST) developed a general set of functional relationships for understanding the structure of discourse.
  - While RST covers much of the structures used in previous approaches to argumentation, researchers has shown that it is inadequate as a model of persuasive argumentation.
  - Further work is required for notations and formal rules that can capture the structures employed in public health messages.

## An Integrated Framework

- The integrated approach we propose takes the view that persuasive health messages have both a logical component as well as the components (threat and action) informed by decades of empirical studies
- An authoring system to assist messages to develop effective persuasive health messages must be grounded in both theories of argumentation and health behavior to inform their development

## Merging Public Health, Linguistic and Argumentation Theories

	<b>Public Health (Content)</b>	<b>Computer Science (Form)</b>	<b>Integrated System (Content + Form)</b>
<b>Theory (KR)</b>	Social Cognitive Models	Discourse Structure (e.g., RST)	Persuasive strategies
<b>Methods (KA)</b>	Empirically Derived principles	Linguistic Analysis	Empirically derived principles conveyed by linguistic analysis

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- The proposed research, which is to optimize the effectiveness of persuasive health messages draws upon decades of research that has been conducted to better understand persuasive health messages, and extends this research to advance current methods for developing tailoring systems.
  
  - Our research seeks to build on current methods for developing tailoring systems by addressing the most important challenges:
    - applying theory to inform both content and structure for more effective persuasive messages
    - assisting authors to translate their theoretical knowledge to inform the messages they develop in practice

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- The chief innovation for message authors utilizing the authoring tool is a graphical notation for constructing arguments (messages) designed to persuade recipients (subjects).
    - Provide message authors with a visual representation of the structure of the argument.
  
    - Enable message authors to see more easily what components are missing, what points need to be bolstered, etc. In addition, an author can more easily compare two similar arguments, and reuse components of one argument in another.

## Evaluate the logical structure that operates to make the argument persuasive

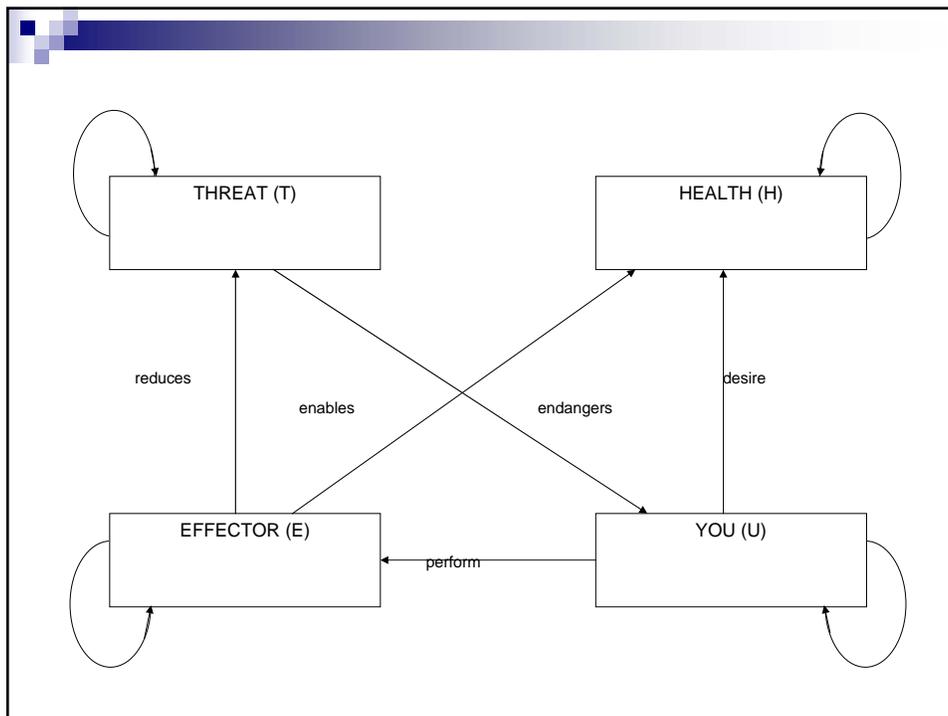
- We seek to develop a formal representation of the logical structure of arguments (the connectives) as well as the content (the statement types).
- To accomplish this, we will examine connective structures across many messages, looking for particular patterns of argumentation, or *argument schemas*
- Our methods employ a combination of discourse analysis [Harris] and argumentation theory [Toulmin]
- Analysis is to determine the content of the message in terms of constructs from public health theory (carried by *statement types*) and the logical structure of the argument (carried by *connective phrases* that link the sentences).

- The goal is to provide an operational method of analysis that can be applied to health messages with good reliability across analysts
- We applied our methods of analysis to a collection of 50 health messages. We created, gathered from Web sites and contributed by public health experts.
- Our goal was to develop an operational method of analysis that could be applied to health messages with good reliability

- Our method of discourse analysis requires identifying elementary sentences (simple declarative form consisting of subject, verb and object), and clustering words into classes based on patterns of co-occurrence. This yielded the following classes:
  - **T** includes any threat that endangers health (e.g., diseases, accidents, addiction)
  - **E** (effector) includes actions that reduces the threat (e.g. screening, exercise, abstinence)
  - **U** designates the group that is endangered by the threat (recipient, black Americans, women)
  - **H** includes states or outcomes desired by the recipient (health, happiness, life, family)

- In addition to identifying the basic types of statements that occur in public health messages, we also analyzed the structures of connective phrases that link them together. These exhibit several distinct patterns that convey a logical argument.

- These four classes form pairs in elementary sentences, often appearing in subject and object positions with a verb connecting them, e.g. *screening detects cancer*.
- Some combinations are **TU** (threat endangers you), **ET** (effector reduces threat), **UE** (you perform effector), **UH** (you desire health) and **EH** (effector enables health).
- These pairs represent the basic types of statements that can be made in public health messages



## Argument schema for health message (logical connectives link the statement type)

Connective	Statement	Elementary Sentence (linguistic paraphrase)	Text
Unless	UE	<i>You get screening</i>	<i>Unless you get screened for colorectal cancer</i>
Then	TU	<i>Cancer kills you</i>	<i>It can kill you.</i>
But	ET	<i>Screening detects cancer</i>	<i>But early screening can detect cancer.</i>
So	UE	<i>You see doctor.</i>	<i>So see your doctor.</i>

## Analysis of a Health Message Connective Statement Elementary Sentence Text

Connective	Statement	Elementary Sentence	Text
People don't think about	TU	People get cancer	Most people don't think about colorectal cancer.
But	TU	Cancer kills people	But it's the second leading cancer killer in the U.S.
	TU	Men and women have cancer	This year, more than 135,000 men and women will learn they have colorectal cancer.
	TU	People will die of cancer	Nearly 57,000 will die of it.
But	EH	Screening saves lives	But regular screening tests could save thousands of lives... including yours.
So	UE	Talk to your doctor	So talk to your doctor and Screen for Life.



## Preliminary Study

- To assess reliability of our methods, we instructed four analysts, and selected 10 messages provided by public health communication experts.
- The messages were of varying length, format, and subject matter.
- The overall chance-corrected agreement (kappa) was calculated to be 0.69 between the four raters.



## Next Steps

- Our next steps, after we collect and analyze the messages, refine our corpus-derived schemas using experts.
- We think that the concept which is to aid the author in building the overall structure of the argument, while allowing the author to craft individual sentences avoids complexity associated with NLG efforts to develop persuasive health messages.

Figure . Graphical tool for creating health messages

