

## TOWARD MORE EFFECTIVE ANTECEDENT STRATEGIES FOR ENVIRONMENTAL PROGRAMS\*

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### ABSTRACT

Antecedent strategies such as information and prompts when used to promote proenvironmental practices, i.e., energy and water conservation, recycling and litter control, use of mass transit or energy saving driving behaviors, are generally believed to be ineffective, particularly in comparison to consequence strategies such as feedback and use of various rewards. A review of forty-one representative studies in behavioral, environmental research indicated that when attention is given to such factors as specificity, proximity, convenience of the behavior, and salience that antecedent strategies can be effective, albeit still considerably less effective than consequence strategies. However, far more striking in the review was the poor design of antecedent strategies, the use primarily of the written medium alone, and the generally singular presentation of the intervention. The development of more effective antecedent strategies is important from a policy perspective since they are generally less expensive to implement than consequence strategies, or may be combined with consequence strategies to optimize outcome. Incorporating concepts and practices from communications and social diffusion theories, as well as more fully exploiting behavioral modeling were discussed as bases for developing more effective antecedent strategies. Examples of media-based and local, personal contact approaches are given to illustrate the potential of more effective antecedent strategies.

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## INTRODUCTION

In the last decade a large number of field studies have investigated the effectiveness of behavioral interventions for promoting environmentally protective practices. The underlying assumption of these studies is that environmental problems have important behavioral dimensions and that, consequently, the development of an appropriate behavioral technology is indispensable—next to a physical technology—in finding optimal solutions for today’s environmental problems [1, 2]. This position has been succinctly stated before: “The ecological crisis is a crisis of maladaptive behavior,” hence “. . . the most feasible solution lies in the immediate changing of critical behaviors on a population-wide basis” [3, pp. 583–584].

The main research areas to which behavioral technology has been applied in this context include: litter control, recycling, population control, transportation, residential energy and water conservation, and to some extent, noise control. The principal objective of most of these studies is the empirical assessment—by means of field experimental research—of both the absolute and relative effectiveness of antecedent and consequence interventions for promoting environmentally protective behavior.

*Antecedent* interventions can be defined as stimulus events occurring *before* the target behavior, designed to increase or decrease the probability of the target behavior. Examples are: information to consumers about energy conservation or about population control and prompting households to recycle certain goods or to conserve water.

*Consequence* interventions, on the other hand, can be described as stimulus events occurring *after* the target behavior, designed to increase or decrease the probability of the target behavior. Examples are: feedback to consumers on their residential energy consumption, rewards to households for recycling efforts, and fining littering along highways. From a policy point of view, behavioral research on environmental problems is relevant for at least two reasons:

1. it can provide policy makers with an empirical, experimentally-based evaluation of the effectiveness of implemented policy interventions; and
2. it can provide policy makers with an empirical, experimentally-based evaluation of the effectiveness of not-yet-implemented, but possibly promising, policy interventions.

Careful examinations and comparisons of the findings of behavioral studies on environmental protection behavior show that, in general, antecedent interventions are quite ineffective in promoting pro-environmental behaviors, whereas consequence interventions are quite effective in promoting such behaviors. All review studies in this research area formulate conclusions in agreement with this empirical generalization [1, 2, 4–9]. Thus, if we take energy conservation as an

example, most studies have shown that providing consumers with frequent feedback on their energy consumption and rewarding them for conserving energy is far more effective than giving consumers information on how to reduce energy consumption or prompting them to conserve [10–13]. Again, from a policy point of view these findings are to some degree disappointing for three reasons.

1. the implementation costs of antecedent interventions usually are much lower than of consequence interventions;
2. antecedent approaches have been and are logical types of governmental interventions (e.g., booklets, TV “spots,” etc.), i.e., where, in economic terms, the present and future “externalities” seem quite favorable but not profitable for one or more firms; and
3. effective antecedent strategies could potentially enhance the effectiveness of consequence strategies. For example, a well and properly informed citizenry could make more appropriate responses to price increases.

In general, the relative ineffectiveness of antecedent interventions is explained by both reviewers and researchers in terms of attitude-behavior discrepancies and/or lacking reinforcing contingencies [1, 2, 6]. Though we do not disagree with these two explanations, we strongly feel that now the time has come to offer a third explanation: Most antecedent interventions in mainstream behavioral, environmental research are characterized by a very low degree of optimality of design. As we will show in Section Two, antecedent interventions are typically one-shot interventions, tend to be rather uncreative (like mailed three-page leaflets), are not designed in correspondence with basic tenets of communications research (e.g., built-in feedback channels, adoption of innovations strategies), and ignore other antecedent interventions (e.g., media approaches). It is important to note, however, that studies investigating limited antecedent approaches have been ecologically valid in terms of precisely following “real-world” efforts. For example, as noted by Geller et al., a prime strategy used by federal and state DOE’s and power companies in the 1970’s was the information booklet [2]. A number of conservation studies have evaluated these same booklets independently and generally concluded that this antecedent strategy is ineffective [12, 13].

Thus, the above-mentioned general finding of the ineffectiveness of antecedent interventions, while concluded from ecologically valid research, nevertheless seems to be only partly true; it solely holds for the rather one-sided and sub-optimal antecedent interventions evaluated so far. Both from the point of view of environmental policy and of scientific progress, this tendency for evaluating poorly designed antecedent interventions is, of course, objectionable. In reviewing the behavioral research on antecedent strategies, we have formed an impression that some behavioral scientists and practitioners in this area may have rooted, preconceived ideas about the low effectiveness of antecedent interventions which consequently seem to generate self-fulfilling prophecies. This

impression gets an empirical basis, however, if one compares the creativity and continuity of consequence interventions with the almost non-creativity and transience of antecedent interventions.

However, it is not the intention of this analysis to denigrate the role of consequence strategies which appear to be quite effective. Rather, more effective antecedent strategies may be combined with consequence strategies to yield optimal outcomes. Or, better designed antecedent strategies may yield outcomes approaching some consequence strategies, but at lower cost, thus making the present analysis of antecedent strategies highly relevant to environmental policies and programs.

The main purpose of this article is to make a plea for designing more powerful and sophisticated antecedent interventions in behavioral, environmental research. In Section Two, we take a closer look at some representative studies in this research area. To illustrate our general statement, we will outline in Section Three some possibly more fruitful directions in which behavioral, environmental research on antecedent interventions could be developed. Section Four will contain some concluding remarks.

## REVIEW OF THE LITERATURE

Table 1 presents the targets, strategies, and outcomes of forty-one behavioral studies in resource management (residential energy conservation, transportation management, water conservation, recycling, and litter control) that have experimentally evaluated antecedent strategies alone, or within the same study have evaluated consequence procedures with or without antecedent strategies. Studies were not included in the table where the effects of antecedent strategies alone were not separately evaluated. The number after each study indicates its place in the reference section. A complete delineation of all behavioral resource studies with analyses and criticisms beyond the scope of the present paper is available elsewhere [2].

The present table is rather meant to be illustrative and representative of the field, but not exhaustive. Note that transportation management is only represented by one study, since no other work could be found that evaluated antecedent strategies alone (e.g., information on car pooling; new transit route map designs), although recent research has stressed the importance of this type of approach [2]. In addition, only one water conservation study met the criteria for inclusion in the table.

Despite these limitations, there are a number of consistent outcomes across the studies:

1. It is quite apparent that studies which only use booklets, flyers, letters and the like generally show no, or at most minimal, change in the target behaviors.

2. More intrusive or personal prompts (e.g., at a person's door), prompts with more specific information, and multiple types or frequent prompts, seem to increase responsiveness.
3. Aspects of the environment such as its cleanliness, the convenience of performing behaviors because of, for example, multiple trash receptacles or the design of receptacles, generally decrease littering and increase recycling.
4. Generally, some antecedent strategies are somewhat effective when attention is directed to the specificity of the requested behavior (e.g., "deposit litter in green can only"); proximity and convenience of the behavior (e.g., providing many places to recycle materials); salience (e.g., a clean environment means no littering), and, perhaps also to intrusiveness (e.g., a prompt at the time and site of purchase), and repetition [2].
5. While it is quite apparent that in studies where the effects of consequence strategies were also evaluated these strategies were far more effective than antecedent strategies, an examination of the table indicates that: a. with some exceptions, antecedent strategies were delivered only once (e.g., a booklet), unless the strategy was a facet of the milieu (e.g., clean environment, new trash cans, a permanent sign); b. generally, only the written medium was used; and c. there are only two studies [20, 46] that used explicit, on-site demonstrations and in vivo or video modeling techniques.

An examination of the table reveals some other interesting consistencies. In most instances, antecedent strategies designed to change private environmental practices such as home energy consumption primarily involved one-shot information booklets and the like. Multiple types and repetitive strategies were more frequently used with more public practices such as littering and recycling. While the nature of the target behaviors should influence the type of intervention strategy designed for the problem, two other factors have probably also influenced the present state of behavioral research—ease of measurement and "historical accident" or tradition.

In the case of home energy consumption, for example, specific target behaviors or processes such as thermostat control are difficult and expensive to monitor and modify. However, obtaining frequent measures of outcome from reading energy meters is relatively simple and inexpensive. It is, therefore, not surprising that most behavioral research on residential energy consumption has investigated the consequence strategy of feedback on energy consumption. But, "tradition" may have played a role also. For example, the earliest littering and recycling studies employed antecedent strategies and this approach still seems to be followed in more recent studies. Behavioral transportation management is represented by only one study in the table possibly because the first [50] and subsequent studies [2] focused on free ridership and other methods to

Table 1. Sample of Antecedent Strategies Used Alone in Resource Management Studies and Outcomes

<i>Study</i>	<i>Target</i>	<i>Strategy</i>	<i>Outcome</i>	<i>Consequence Outcome</i>
Geller (1981) [14]	Insulation of hot water heater; installation of water flow limiter	Pamphlets, workshops, one face-to-face prompt	Minimal change	
Hayes and Cone (1977) [10]	Electricity use, but not for heating or cooling	Poster describing conservation steps	No change	Rebates and daily feedback yield 20%–30% reduction
Heberlein (1975) [11]	Electricity use for space heating	Letter encouraging conservation plus saving tips	No change	
Kohlenberg and Anshell (1980) [15]	Electricity use, but not generally for space heating	Literature and booklets	No change	Rebates, rate changes, and different feedback strategies marginally effective, but a very low rate area
Kohlenberg et al. (1976) [16]	Peak load electricity use	Booklets	No change	Feedback light, daily feedback, monetary payments yield marginal peak-load reductions
Luyben (1981) [17]	Lighting in unoccupied rooms	Single and multiple written prompts	Only multiple prompts reduced unnecessary lighting by 12%	
Palmer et al. (1978) [18]	Electricity use	Letter asking for reduction	No change	Daily feedback yields 10% reduction
Winnett (1978) [19]	Lighting in unoccupied rooms	Large, strategically placed signs	60% reduction in unnecessary lighting	
Winnett et al. (1978) [12]	Electricity for space cooling	Booklet	No change	Rebates yield 10%–16% reduction

Winett et al. (1981) [20]	Electricity for space heating and cooling	Videotape programs demonstrating conservation practices	Reduction of electricity use by 9%–15%	Daily feedback alone or with video programs yields 15%–20% reduction
Winett and Nietzel (1975) [13]	Electricity and gas for space heating	Booklet	No change	Rebates yield 15% reduction for electricity
<i>Residential Water Conservation</i>				
Buttrum and Geller (1981) [21]	Interior and exterior water use	Booklet	No change	Daily feedback yields no change, but possibly because of low-cost of water
<i>Transportation Management</i>				
Van Houten et al. (1980) [22]	Speeding cars on a highway	Large posted sign	No change	Indicating on the sign the percentage of nonspeeders during a day or week reduces percentage of speeding cars
<i>Resource Recovery</i>				
Arbuthnot et al. (1977) [23]	Participation in recycling program	Door-to-door survey, flyer, bag for cans, appeal letter	Combination of strategies yields high rate of compliance as judged by phone calls	
Geller et al. (1975) [24]	Purchase of returnable bottles	Flyers distributed at store entrance	20% increase	
Geller et al. (1975) [24]	Recyclable paper	Signs and poster in dormitory	141 lbs. per week, but only 2.2% participation rate by students	Payments or raffles for paper more than doubles participation rate and increases paper collected by 70%

Table 1. (Cont'd)

<i>Study</i>	<i>Target</i>	<i>Strategy</i>	<i>Outcome</i>	<i>Consequence Outcome</i>
<i>Resource Recovery (Cont'd)</i>				
Hamad et al. (1977) [25]	Recyclable newspapers	Verbal prompts in elementary school classes	198 lbs. per week	Between class contests and public feedback yields 2,600 lbs. per week
Humphrey et al. (1977) [26]	High grade paper in administrative offices	Different types of waste baskets	About 90% of paper recycled	
Ingram and Geller (1975) [27]	Recyclable paper in dorms	Flyers	About 53 lbs. per week and 3.5% participation rate	Increase in participation and double poundage by use of raffle coupons
Jacobs (1978) [28]	Newspaper recycling in community	Flyer	Increase in participation rate, but not in amount collected	Quadruple rate of participation, but not amount collected with use of payments and raffles
Jacobs and Bailey (1979) [29]	Newspaper and aluminum can recycling in community	Flyer, phone calls, newspaper ads, door-to-door prompting, recycilit containers	Door-to-door prompting and recycilit containers increase participation rate	Stickers to show recycle and convenient pickups yield about 35% increase in participation rate
Luyben (1980) [30]	Recyclable beverage containers in dorms	Posters and collection containers	About a 19% increase in recycled containers	
Luyben and Bailey (1979) [31]	Recyclable newspapers in community	Special boxes, flyer	175 lbs. per week and 52% increase	Payment of toys for pounds collected plus posters, flyers, and a special vehicle more than doubled amount collected
Ried et al. (1979) [32]	Recyclable newspaper in community	Special box, signs, door-to-door appeal	About 10.5% lbs per day collected, an increase of about 50%	



	Recyclable paper in dorms	Flyer	49 lbs. per week and 2.6% participation rate	Payments and raffles yield about 700 lbs. per week and 9% participation rate
Witmer and Geller (1976) [33]				
<i>Litter Control</i>				
Baltes and Hayward (1976) [34]	Litter reduction in stadium	Litter bags plus instruction	45% reduction	Lottery yields same reduction
Burgess et al. (1971) [35]	Litter in movie theater	Verbal instructions and litter bags	57% of litter picked-up	Free movie ticket or payment for a litter bag results in 95% of litter picked-up
Chapman and Risley (1974) [36]	Yard litter	Verbal appeal and litter bag	34 lbs. per day turned in by 10 children	Payment for bags of litter or for keeping a specific area clean decreased litter more than appeal and bags with more participating children
Cope and Geller (1981) [37]	Taking and using litter bags at a restaurant	Verbal prompts	48% take bags, 28% use bags	Free drink even if do not use bag results in 50% increase in use
Dodge (1972) [38]	Campsite litter	Flyer, bumper sticker, newspaper ads	Decrease in litter by about 90%	
Finnie (1973) [39]	Highway litter, sidewalk litter, wrapper litter, trash can disposals	Increased number of cans; decorated cans, clean vs. dirty milieu	Increased cans decrease litter by about 23%; decorated cans increase disposal by 15%, and clean environment decreases litter by 17%	
Geller (1973, 1975); Geller et al. (1976, 1977) [40-43]	Handbill disposals in movie theater and grocery store	Specific disposal instructions	20%-30% increase in trash can disposals	

Table 1. (Cont'd)

<i>Study</i>	<i>Target</i>	<i>Strategy</i>	<i>Outcome</i>	<i>Consequence Outcome</i>
<i>Litter Control (Cont'd)</i>				
Geller et al. (1981) [44]	Trash can disposal and ash tray litter in a shopping mall	Special cans, redesigned can	Redesigned can results in 84% reduction in ash tray litter	
Heberlein (1974) [45]	Handbills on floor	Clean vs. littered hallway	About 3 times as many handbills on floor in the littered milieu	
Jason et al. (1979) [46]	Dog feces on streets	Litter bag "pooper scooper," instructions and modeling	75% increase in pick-up	
Kohlenberg and Phillips (1973) [47]	Trash can deposits	Sign	23% increase	Drink coupon given on a variable schedule yields 73% increase
LeHart and Bailey (1975) [48]	Litter on a nature trail	Lecture and education materials	67% decrease in littering, but no increase in pick-up of litter	Giving a badge for pick-up specially marked items led to 76% increase in picked up litter, but no decrease in littering
Robinson and Frisch (1975) [49]	Handbills on post office floor	Clean vs. littered floor	About five times more handbills on floor in littered milieu	

Adapted from Geller et al. in press [2].

reinforce ridership, i.e., a consequence approach. Thus, measurement capabilities and the starting point of research may greatly influence the direction and scope of subsequent development of a paradigm.

While these points are important in understanding the development of the field, the central themes of this paper, supported by the table, are that: 1) under some conditions antecedent strategies are somewhat effective, but 2) it appears that multifaceted, more creative antecedent strategies have generally not been investigated. To conclude that all types of antecedent strategies are ineffective, is obviously not warranted. We now turn to a discussion of conceptual bases and practical directions for the development of more robust antecedent strategies.

### DIRECTION FOR FUTURE BEHAVIORAL RESEARCH ON ANTECEDENT INTERVENTIONS

In this section we will extend our general argument by giving some examples of antecedent interventions which might be more effective in promoting environmentally protective behavior than the ones investigated so far. An analysis of the repertoire of antecedent interventions evaluated in behavioral, environmental research indicates that for some unknown reason, not all standard interventions for behavior change have been included and applied, certainly not in combination (see Table 1). A clear illustration of this conclusion is the fact that one of the most powerful interventions—*modeling* [51]—has almost been overlooked in behavioral, environmental research. As we noted, there appears to be only two studies on the application of modeling principles [20, 46].

Other antecedent strategies that have not been well investigated include stimulus control tactics, chaining, and rule-giving. For example, in video-tape programs demonstrating home conservation behaviors, models were depicted as they developed a set of rules in the summer for when to use air conditioning or fans. In the winter program, models were shown working out a chain of behaviors that would lead them to turn the thermostat to 55° F at certain times, i.e., when leaving the home or going to bed, the latter case being an example of stimulus control [20]. Thus, diverse antecedent strategies from the behavioral framework need to be more fully implemented and evaluated, a point we will return to later.

More behavior analyses also need to be directed toward ascertaining the reasons why particular antecedent strategies do not work. For example, with information booklets it seems important to know if consumers threw the booklets away; glanced at the booklets, but did not like the format; did not understand the material; understood the material, but wanted some more advice, etc. In other words, to more effectively design antecedent strategies, we need feedback from consumers. Although such data is seen as a legitimate and important aspect of behavioral research [52], it appears that such data are missing from many behavioral, environmental studies.

Another quite striking conclusion is that most behavioral scientists in the environmental area have not incorporated and applied general findings from related social science disciplines. A clear example is the almost total neglect of results of diffusion of innovations research, a long and well established research tradition [53-57]. Within this research tradition, significant theoretical and empirical knowledge has been gathered with regards to the question of under what conditions innovations are and are not adopted in society (e.g., adoption of more efficient agricultural technologies by farmers, diffusion of medical knowledge in medical circles, adoption of birth control methods in Third-World countries). Thus, diffusion research studies factors regulating adoption of innovations in certain contexts.

The main reason why diffusion research is of vital importance for environmental research is that changing environmental destructive behavior into environmental protective behavior is, in fact, the adoption of innovative behaviors [58]. The adoption of such practices as car pools or products such as home retrofitting material can be seen as the diffusion of innovations. Consequently, application of diffusion of innovation principles can be extremely useful for environmental behavioral research. More specifically, these principles can provide a general framework for the different phases of the decisionmaking process with regards to the diffusion and adoption of environmentally protective behavior [58, 59]. In addition to this, diffusion theory can offer hypotheses on the influence of communications and social networks on the adoption of environmentally protective behavior.

Diffusion theory emphasizes the important role of the media in providing information on innovations and influencing a select minority of people to adopt innovations. These early adopters often serve as behavioral models for later adopters. However, diffusion theory and field studies also emphasize the integrated role of media and personal contact, and particularly the important role played in local settings, such as neighborhoods, by early adopters and/or local leaders. For example, personal contact from a neighborhood leader who has a retrofitted home may be an important element in the decision of a homeowner to retrofit his/her home. Diffusion theory also provides some guidelines on elements of an innovation related to adoptiveness including the fit of the innovation with the local setting, awareness of the innovation, support by significant others, its simplicity and flexibility, readily available feedback on the success of the innovation, and its trialability. The integration of behavioral principles with diffusion theory for community development purposes has been recently suggested by other writers [60].

Another neglected, though closely related, area in behavioral, environmental research is communications theory [61, 62]. We are especially referring to that part of communications theory which is concerned with necessary conditions for communications (e.g., information campaigns, education programs) to be effective in changing attitudes and/or behavior. For example, one thing that

communications theory stresses—and which is almost always lacking in behavioral, environmental research on antecedent interventions—is the necessity of built-in feedback channels for intervention programs. If for instance, an informational campaign is set up for promoting energy conservation by consumers, we should make sure that the communications flow is not one-sided (research team → consumers), but two-sided (research team ↔ consumers). The target group, at any time, should have the possibility to respond to the communications, to ask for additional information, etc. This need for response can be facilitated by built-in feedback channels. These channels are clearly lacking in behavioral, environmental studies, as they are characterized by one-sided communications. As we saw in Section Two, most studies use very simple antecedent interventions, e.g., mailed leaflets or brochures about the target behavior.

Other points from communications theory which are of importance to behavioral, environmental research regard questions like:

1. What is the pre-intervention need of the target group for the intervention communications?
2. What is the degree of homogeneity/heterogeneity of the target group? Should communication messages be segmented?
3. How does the target group perceive and evaluate the intervention communications (reliability, conviction, power, reactance, etc.)?
4. How should optimal (in terms of effectiveness for attitude and/or behavior change) communication messages be designed?
5. Which media should be used?

Maccoby and Alexander have also recently detailed important facets of communications that should be present to facilitate behavior change including carefully setting an agenda [63]; providing a rationale for changing a practice and precise information about the behavior change; providing methods of training for the behavior change; describing and showing the gains accruable from engaging in the new behavior, thus providing motivation and reinforcement, and setting up ways for the new behavior to be maintained. Maccoby and Alexander disputed the axiom in the field that media-based approaches will not change behavior. Consistent with this paper, they argued that state-of-the-art media programs have rarely been implemented, but when sophisticated communication strategies have been used such as for community-based health promotion efforts, there is some evidence for behavior change [63].

Elsewhere, the second author has reviewed the careful planning and evaluation that were involved in a number of children's television workshop programs that evidently promote both attitude and behavior change [64]. Thus, behavioral approaches also need to be integrated with current work in communications.

The various assets of communications theory have generally not been

incorporated into behavioral, environmental research. We suggest that this deficit offers one conceptual explanation for the ineffectiveness of antecedent interventions.

In the remaining part of this section, we will give some examples of antecedent interventions which go beyond the ones most popular in behavioral, environmental research and which may be as effective as, and certainly complimentary, to consequence interventions. Again, we underline the fact that consequence interventions have proven to be quite successful in promoting environmentally protective behavior. Our main argument is, however, that the implementation costs of antecedent interventions are usually lower and, thus, more important from a policy point of view and that the effectiveness of antecedent interventions may be increased considerably by improving their design.

## SUGGESTED RESEARCH

### Modeling

As we stated before, modeling (especially participant modeling) is a very powerful intervention for behavior change, yet has rarely been applied in the environmental area. Nevertheless, there seems to be no reason why modeling should not be utilized in this area. The second author and his students have shown that a persuasive, specially prepared videotaped program that demonstrated ("modeled") very practical energy conservation methods was an effective and promising intervention for reducing energy consumption [20]. An interesting aspect of modeling in this respect is that it can easily be combined with media approaches as the above mentioned study already indicates. This form of "symbolic modeling" is especially promising because of its large-scale application via TV [51].

Participant modeling, the most effective behavior change strategy [51], has been infrequently used in environmental programs. Participant modeling may be affected by having, for example, home energy auditors not only tell a consumer what behavioral and retrofitting steps need to be taken, but by having the auditor give step-by-step demonstrations of basic strategies to the consumer with some subsequent follow-up provided. It is not clear if current auditing programs follow this approach. Thus, one direction for future research might be to explore in more detail the applicability of modeling principles for promoting environmentally protective behavior (e.g., energy audits, make use of high-status persons as models for antilitter behavior or local recycling efforts, TV programs, etc.).

### Media Approaches

It is almost like forcing an open door to say that mass media are an indispensable part of modern society. Today's communication processes would be

unthinkable without our mass media. To some degree, behavioral scientists have become intrigued with the potential of television and other mass media for behavior change, especially in the field of health promotion efforts [65]. There are, however, few studies on the use of mass media for promoting environmentally protective behavior [2]. Some examples can illustrate the usefulness of mass media in this area.

There is some empirical evidence that specific prompts are moderately effective in encouraging environmentally protective behavior [1, 2]. Given its large-scale range, it would be interesting to study the effectiveness (including cost-effectiveness) of mass media in prompting pro-environmental behaviors. For example, we have noted that prompting strategies have generally only used the written medium. We are intrigued with the possibilities of making prompts extremely visible, timely, and salient by delivering them over TV and radio. For example, viewers can be requested to turn back their thermostats in the winter after the eleven o'clock news and be shown people performing the set-back at that time. Commuters may be prompted to wear seat belts during radio shows that are frequently listened to during commuting times. Feedback can be built into these media efforts by providing daily information on energy saved in an area, samples of drivers wearing seat belts, etc. There is, indeed, some experimental data that such aggregate feedback approaches may be moderately effective [22, 66].

Behavioral principles may also be used in conjunction with "spots" and ads prompting pro-environmental practices. For example, there are ads for overhead fans and quartz heaters that apparently used such behavioral principles as depicting coping models, showing the models being reinforced for using the products, noting the specific practices affected by the products, and the advantages of the products. The ads were in stark contrast to more typical public service announcements or appeals to "sacrifice" for conservation that have often been used and described elsewhere [67].

There are, however, numerous other applications. If we take residential energy conservation as an example, the effectiveness could be studied of specially developed television programs in which people are instructed on which technical and behavioral changes are adequate energy conserving measures, how to monitor their own energy consumption, how to calculate cost-effective energy investments, etc. Especially at a time when it appears that local television may become an important medium, such programs seem to be quite promising. For instance, local community energy conservation plans could be developed, involving both the residential, commercial, and industrial sector, in which local television provides the community with information about the program, specific and effective energy conservation tips, frequent feedback on conservation outcomes, and other forms of reinforcement for conservation efforts. The interesting thing about these kinds of media applications is the possibility of a planned combination of different principles of behavior change,

i.e., elements of modeling theory (high-status, local residents); diffusion theory (use of existing local networks); communications theory (optimal design of television messages), and social learning theory (prompting, feedback, self-monitoring, goal-setting, reinforcement), applied in a coherent and consistent way.

### **Social Networks Approach**

There is convincing empirical evidence that social networks' characteristics are of fundamental importance for the diffusion of innovations [53, 56]. Especially characteristics like openness/closedness and homogeneity/heterogeneity tend to be important. However, there are surprisingly few studies on the diffusion and adoption of environmentally protective behavior. An interesting exception is a study by Darley [58] who looked at factors favoring the adoption of an energy conserving thermostat. In accordance with general diffusion theory, Darley found that, among other things, adoption of the thermostat depended on the degree of encouragement by influential others [68]. In Darley's words "... diffusion proceeds along sociometric rather than spatial networks" [58, p. 325]. From general diffusion theory, we know that this seems especially the case within homogeneous networks characterized by strong network relations [56]. Though it might be true that sociometric networks are more important than spatial networks in explaining the diffusion of innovations, it should not be overlooked that spatial networks may frame sociometric networks in ways that may be important to environmental protection. Warren and Clifford found that neighborhoods with strong (cohesive) social networks conserved more energy than neighborhoods with weak (non-cohesive) social networks [69]. Their hypothesis is that "... norms of household energy usage are filtered through geographically-based social units such as neighborhoods and local communities." [69, p. 3]

We have also previously alluded to the potential of more local programs that tap or develop social networks. A highly effective strategy may consist of working directly with neighborhood leaders or respected individuals and changing their environmental practices. These leaders may then formally or informally serve as instructors and models for other neighborhood residents essentially creating a local snowballing effect. This point plus the work of Katz and Lazarsfeld and Warren and Clifford seems to have important policy and research implications: "Without having an adequate link to social structure, and communities, federal policies or other macro-societal programs are not liable to harness the willingness of individuals to take voluntary action." [69, p. 14]

## **CONCLUSIONS**

A general finding of behavioral, environmental research is that consequence interventions are more effective than antecedent interventions in promoting



environmentally protective behavior. From a policy point of view, this finding is rather disappointing as the implementation costs of consequence strategies are usually significantly higher than for antecedent strategies and antecedent approaches seem appropriate for government interventions. The ineffectiveness of antecedent interventions is generally explained by behavioral scientists in terms of lacking reinforcing contingencies and/or underlying attitude-behavior discrepancies.

In addition to these two explanations, this article offers a *third* explanation. Antecedent interventions are very poorly designed in mainstream behavioral, environmental research. Thus, it may be that antecedent interventions could be more competitive with consequence interventions if their design was more creative, optimal and sophisticated. Also, antecedent interventions are often implemented without incorporating and applying general findings from related social science disciplines, in particular, communications and diffusion theory. Moreover, not all standard behavioral interventions, such as modeling, have been applied to changing environmental behavior.

It might very well be that if these short-comings would be overcome, antecedent interventions may be more effective. The examples we gave (modeling, media approach, network approach) of possibly more optimal antecedent interventions could be tested empirically to see if this hypothesis is true. Again, we emphasize that such an empirical test should be as powerful as possible. From our perspective, this means experimental field research.

These alternative directions for behavioral, environmental research imply, however, certain changes by behavioral scientists themselves. We should be as creative in designing antecedent interventions as we are in designing consequence interventions; critically examine our often rooted, pre-conceived ideas about antecedent interventions, and be willing to consult other social sciences. Finally, we realize that trying to convince our colleagues to experiment with diverse and multidimensional strategies in itself involves the adoption of an innovation. We would be remiss to believe that such a change in the field would be accomplished by only the present article and through the written medium. Hence, we are also involved in the development and dissemination of behavioral, environmental research through radio and TV presentations, network building, and workshops and conferences.

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