An Assessment of Games as Methods of Providing Information on Gasoline Conservation

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The potential of informal game-type methods of informing conservers about transportation energy conservation is investigated. In an extension of earlier work on activity-based games, four separate procedures are developed that use simple cards and/or playing boards. Energy, money, and mobility impacts of actions are obtained from consumer response data on opinion polls and built into each procedure to varying degrees. The four methods are then tested on a small group of transportation analysts and planners and compared. Results show that the procedures differ widely in playability and realism but are generally well-received and interesting. Although the major use of such tools appears to be as teaching devices, their use as policy analysis and research procedures is also possible. It is concluded that the approach has enough potential to warrant further development.

In light of current economic and energy-related events, U.S. consumers and policymakers must find ways in which to deal with constraints on energy, money, and mobility. Whereas government urges carpooling, use of transit, and driving slower, these methods are not always consistent with the ways people cope (1). Consumers are internally consistent, since they attempt to maintain mobility.

How much personal conservation is possible? According to the Harvard Business School (2), the U.S. could save 30-40 percent of its energy consumption with very little change in life-style if a serious conservation program were implemented. One important factor would be increased transportation vehicle efficiency, both in design and use. Consumers have already moved rapidly in this direction: Average new-car efficiency in New York State in 1980 was 12 percent better than in 1979; this made possible a 4.7 percent cut in gasoline use with only a 0.5 percent cut in travel (3). It seems the public knows how to conserve gasoline.

Conservation options other than those mentioned above are available, but the information provided by government has not had much impact on their use. We suggest that one reason for this failure is that this information is not believable, probably quite boring in presentation, and ineffective. It is the goal of this study to investigate information programs that avoid these problems and that are nonpainful, informative, and highly relevant to current patterns of energy use.

The procedures described in this study have been developed on the principle that nonpainful information transmission is far more likely to be internalized by consumers and retained for future use. The methods generally resemble games based on cards, boards, or other common items but focus on energy-use strategies.

A wide range of realism is, of course, possible by using this approach. By simulating "real life" as much as is feasible, without making the complexity so great as to render the game unplayable, the policy analyst can transmit highly relevant information to the consumer. In this sense, the project is designed to be an educational device to inform consumers of ways in which they can conserve fuel. But, in addition, the procedures can be useful policy research and analysis tools to help policymakers determine and anticipate consumer reactions to various policy decisions or external events. This paper describes procedures developed by the Planning Research Unit of the New York State Department of Transportation (NYSDOT) to fulfill these two objectives.

Games have been engaged in by all cultures for recreation and sport, but as far back as 1780 they were also used to teach military tactics (4), and this use continues today. In addition to military uses, games have been found to have application in business and industry, where they can be a more effective training device than other, more traditional methods because they offer the participant the opportunity to learn by doing and can provide a good deal of practical experience in a restricted time span (3). Applications in education are also widespread.

In transportation, a major center of game-type work is the University of Oxford, England. There, a simple household activity-travel simulator (HATS) (5) has been developed to examine everyday household decision making and behavior. HATS is not a true game but a data-collection device to investigate household activity and travel patterns as well as the manner in which they adapt to the imposition of various constraints. A similar procedure was developed by the Planning Research Unit of NYSDOT to examine how households respond to energy constraints imposed by various government policies (1), and similar devices have recently been reported by Burnett (6) and Brög (7).

APPROACH AND RESULTS

Development

The above ideas suggest further investigation of informal game-like devices for encouraging energy conservation. The primary objective of the study was to develop educational tools. It was felt that the purpose of a policy analysis tool could best be accomplished by other methods. To ensure similarity of basic input data in each design, ongoing work by NYSDOT was used to prepare estimates of the savings and costs associated with energy conservation actions. Table 1 summarizes this work, which is described in more detail by Hartgen and Neveu (8). Estimates of mobility impact are judgmental. This material was used to varying degrees in each of the designs. After initial discussion of the basic components desired in the devices, researchers worked separately (to prevent the "watering down" of ideas that is quite prevalent in committee work). The result was the development of four different designs, which are briefly summarized below.

Designs

The four designs, described briefly below, are (a) Energy Rummy, (b) Calendar, (c) Ring, and (d) Spiral.

Energy Rummy is a card game in which each player shows cards of different fuel-saving actions and "points" (gallons of gasoline saved by each action). There are three levels to the game, each of which is reached by the acquisition of a set number of points. Level 1 requires players to acquire 35 points from the cards before moving to level 2, where 45 more points are needed, and then to level 3, where 55 more points are needed. The first

Table 1. Savings and impacts associated with various energy conservation actions.

Category	Action	Savings If Action Is Taken		
		Energy (gal/week)	Money ($/week)	Change in Mobility[a]
Work	Use bus or subway	6	10	–10
	Carpool	11	15	–8
	Walk or bicycle	1	5	–15
Shopping	Shop closer to home	2	3	–1
	Combine shopping trips	1	2	–1
	Shop less often	2	2	–1
	Use bus or subway	3	2	–5
	Shop on way home from work	2	3	–2
	Carpool	2	5	–2
Car	Buy fuel-efficient car	20	30	–2
	Tune-up	6	10	+3
	Drive slower (55 miles/h)	1	5	–1
	Sell car (do not replace)	20	40	–10
Vacation	Use plane, bus, or train	8	15	–2
	Vacation closer to home	2	10	–3
	Sell boat or other recreational vehicle	1	5	0
	Cancel vacation	5	30	–4
Moves	Move closer to work	8	10	–6
	Change jobs	8	10	–4

[a]Based on minimum value of –20.

player to complete level 3 wins. Also in the deck are "good news" and "bad news" cards that reflect the fluctuation of gasoline price and supply, which change the point values needed for the levels not already played. Figure 1 shows the setup for Energy Rummy. The game is a combination of luck (cards drawn) and skill (card grouping and trading).

Calendar (see Figure 2) is a simple game played with dice and a score sheet. Players roll the dice in turn, and appropriate actions are determined by the roll of the dice. The corresponding saving is based on estimates calculated from the data in Table 1. The object of the game is to save gallons of gasoline over a year's time by (a) making small changes in work, shopping, and social-recreational travel; (b) changing vacation travel; and (c) taking other one-time actions that yield large energy savings, some of which have a high investment cost. Since the game is entirely a matter of luck, learning takes place through repeated exposure to the game results.

Ring (see Figure 3) is a board game made up of three rings of squares and a "win" circle. The color-coded squares indicate the different spheres of life in which the actions may be taken (such as work, shopping, and recreation) and the gasoline saved annually by engaging in the action square. The outer ring is made up of minor actions, such as trip chaining, that save relatively small amounts of gasoline. The middle ring consists of actions that afford greater savings than those of the outer ring, and the inner ring has actions that are major actions in terms of fuel savings, monetary expenditures, and/or inconvenience. The object of the game is to travel around each ring enough times to accumulate the fuel savings and money needed for entry to the next ring and until, finally, entry to the win circle is achieved. The first player to enter the win circle wins the game. The game is primarily one of luck.

Spiral (see Figure 4) is a board game in which a spiral is divided into squares. The players travel around the board, and the first one to enter the center of the spiral wins. Along the way, the players land on different "event squares", which direct them to pick cards representing positive and negative events to which one player or all players must react. In order to meet the changes required on the event squares, the players must play action cards that they were given at the beginning of the game. These cards are played to respond to energy and mobility constraints resulting from event cards. Players must also change the distribution of money in their monthly budget or make changes in their indices for mobility and energy use. The game is useful to the policy analyst because it seeks to determine what type of actions players will or will not play when confronted with the various constraints imposed. It is a combination of luck and skill.

The characteristics of these games are summarized in Table 2.

Survey and Results

The sample size was small (7–10 players/game) and consisted of NYSDOT staff and members of the local chapter of the American Planning Association (APA). This sample was not random but was deemed adequate because the main objective at this early stage in the development of the games was to check on their playability and work the "bugs" out. Since the size of the sample was so small, concrete conclusions regarding the games cannot be made. However, even with this small sample size, general trends might be evident. Clearly, much more developmental work is needed.

A rather small, informal survey was taken after the playing of the games. The technique used was a combination of a brief questionnaire filled out by the player and the verbal responses of the players regarding the games. Table 3 summarizes the results.

Analysis

Generally speaking, all of the games were found to be fairly interesting by the players. However, in terms of challenge, Spiral was found to be more challenging than the other games. While the players of Energy Rummy, Ring, and Calendar found the level of challenge to be too easy or okay, players found the challenge of Spiral to range from adequate to too hard. Spiral requires each player to react to various policies and/or events by making changes in energy and mobility and monthly budget. Since many variables are associated with the decisions, each decision play is time-consuming and demands concentration. By contrast, Ring, Calendar, and Energy Rummy are faster games in terms of length of time devoted to each turn. They are also governed by a good deal of chance rather than deliberate decision making.

The most likely reasons why players found Spiral

Figure 1. Setup for Energy Rummy.

to be a little too challenging at times are that the game requires a good deal of concentration, dealing with many variables, and maneuvering a budget. Yet, in all likelihood, these reasons probably account for the players' feeling that Spiral had more realism and taught them more about energy conservation.

Ring, Calendar, and Energy Rummy depend on the "learning through repetition" technique. By this is meant that the players acquire information not so much by concentrating intensely on each individual energy-saving action as by repeated confrontation with these actions. In Ring, the intention is for the players to travel around each ring several times, thereby associating actions with their respective fuel savings. Players know that fuel can be saved by all the actions on the board and, after repeated playings, they come to learn which actions can save them more than others. The players do not intensely concentrate on the exact amount of gasoline each action saves, but through playings are exposed to and, it is hoped, learn the various methods of fuel conservation, which can then be used in their real lives.

Energy Rummy basically relies on the same principles as Ring to teach its players about fuel conser-

Figure 2. Score sheet for Calendar.

	MONTHLY			Costs (Credits)			CONTINUOUS							Gallons Saved	
	Work	Shop	Soc/Rec	Earned	Used	Bal. Fow'd	Drive Slower	Sell RV/Boat	Tune Up	Move Job	Move Home	Buy F.E. Car	Sell Car	For Month	Year to Date
JANUARY															
FEBRUARY															
MARCH															
Spring Fever Weekend															
APRIL															
MAY															
JUNE															
4th of July Weekend															
JULY															
AUGUST															
SEPTEMBER															
Labor Day **Weekend**															
OCTOBER															
NOVEMBER															
DECEMBER															
Seasons Greetings															
Grand Total Gallons Saved															
% Reduced															

	MONTHLY			
Roll	Action	Work	Shop	Soc/Rec
3	Lose Job	Lose	Turn	
4	Walk/Bike	5	1	1
5	Bus/Subway	15	3	3
6	Carpool	10	1	1
7	Drive Alone	0	0	0
8	Closer to Home	--	2	1
9	Do it less	--	1	1
10	Combine shop/other	3	3	3
11	Accident	Lose Turn & Gal.		

Must move job before you can walk/bike to work
Must move home before you can use busline.

	HOLIDAY	
Roll	Action	Gal. Saved
2-4	Cancel Plans	8
5-7	Use Train/Plane/Bus	8
8-10	Closer to Home	4
11-12	No Change	0

	CONTINUOUS		
√	Cost	Action	Gal. Saved
	1	Drive Slower	1
	2	Sell RV/Boat	2
	3	Tune Up	4
	4	Move Job Closer to Home	7
	5	Move Home (on Busline)	7
	6	Buy Fuel Efficiency Car	20
	7	Sell Car (Do Not Replace)	30

Figure 3. Game board for Ring.

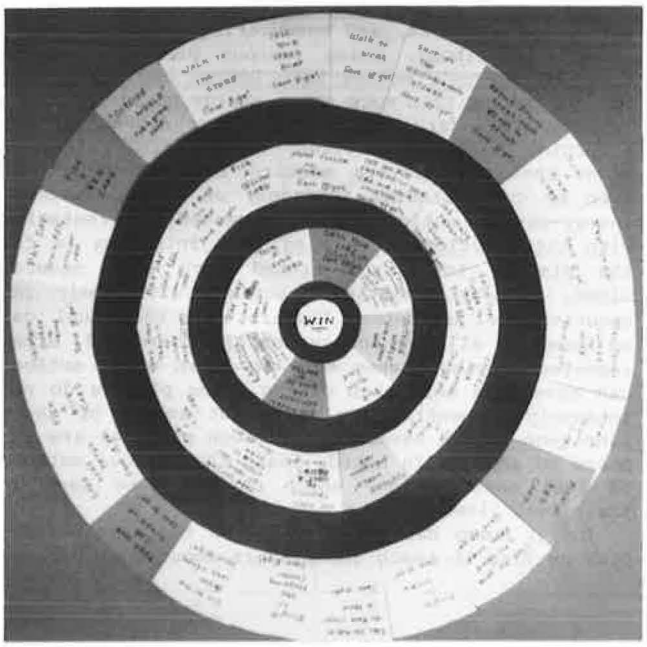
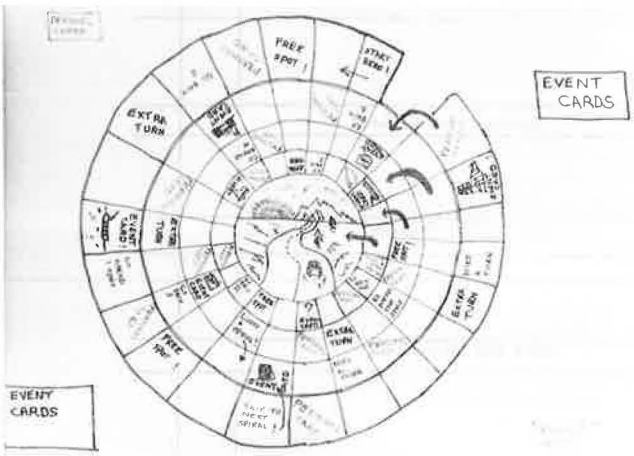


Figure 4. Game board for Spiral.



vation: exposure and repetition. By holding the various fuel-saving action cards in their hands for the length of the game, the players become familiar with actions and their gasoline savings. By repeatedly looking at these cards and using them for the various melds and point requirements in the game, the players realize that those actions that are valuable in the game are also valuable energy-saving actions in the real world.

Calendar, like Ring and Energy Rummy, also operates on the principal of teaching through repetition. The throw of one die determines what type of energy-savings action the player takes. By the repeated throwing of the die to determine which action is to be taken and the energy savings associated with this action, it is hoped that the player learns the significance of this action in his or her own life.

The question appears to be not whether the players learned anything but how much. Although no quantitative answer can be given to this question, responses to the questionnaire lead us to believe that the players did not learn as much as we had hoped. This is true of Energy Rummy, Calendar, and Ring and, to a lesser extent, Spiral. Although Spiral players did feel they learned more about fuel conservation than players of the other games, it is somewhat doubtful that what is learned in any of the games is carried over into real-life situations: When asked whether their responses were "real", most players said yes to all games. The results are inconclusive for possibly other reasons. First, since Energy Rummy, Calendar, and Ring use the principle of repetition to encourage learning, it could be that the games were not played enough times by each player for them to absorb the information and thereby make changes in their life-styles. A number of the sample players were affiliated with NYSDOT and may have been exposed to the concepts the games were trying to convey. Since they were already aware of, and possibly using, many of these fuel-saving actions, they may have learned little else that was new to them and thus reacted in much the same way after playing the games as they did before.

Up to this point, our main concern has been the educational value of these games to the players. Now, focus is given to the value of the games to the policy analyst.

From the data collected on the games, Energy Rummy, Ring, and Calendar appear to have limited value as policy research and analysis tools. These results were expected. As mentioned previously, these games, as they were envisioned by their creators, were to serve primarily as an educational device for the players and last, if at all, as a research tool.

Energy Rummy, Calendar, and Ring are not very close approximations to reality; therefore, the player's main objective is planning his or her optimal strategy to win the game, and this strategy may or may not be similar to one that may be used in real life. For example, a player may sell his or her car in the game with little hesitation because by taking this action he or she can win the game. However, in real life, a player may not be as quick to sell his or her car as in the game situation. This means that game actions are not necessarily indicative of actions that will be taken in real life, and little can be learned by the policy researcher in watching Ring, Calendar, and Energy Rummy.

Spiral, however, is another matter. Our data substantiate the fact that this game has greater potential as a policy analysis tool, as was intended by its developer. By watching decisions about actions and budgets, the researcher can see how consumers will react to various policies and events. The researcher may also "stack the deck", to evaluate selected policies. For example, as players react to a gasoline shortfall, within financial constraints, mobility can be studied. The researcher may find that players are quick to take money out of their recreation budget but are hesitant to engage in major fuel-saving actions that will restrict their mobility or require large capital outlays, such as moving closer to work. Under a policy that results in an increase in money or gasoline supply, the researcher may find that the players are quick to dispense with minor actions such as slower driving and tune-ups.

Overall, Spiral was the only game out of the four that could have major value as a data-collection tool. All of the games, however, have potential as educational devices.

CONCLUSIONS

Is the game approach to disseminating and collecting information a worthwhile endeavor? At this writing, given the limited amount of research that has been

Table 2. Characteristics of four energy conservation games.

Game	Pieces Required	Goal	Character	No. of Players	Primary Objective
Energy Rummy	Cards	Save gasoline	Mostly luck	3-4	Education
Calendar	Score sheet	Save gasoline	Luck, skill, and balance	2-3	Education
Ring	Board, playing pieces, dice	Save gasoline and money	Luck and skill	2-3	Education
Spiral	Board, playing pieces, dice	Maintain mobility	Luck and skill	2-4	Education and policy

Table 3. Summary of evaluation of energy conservation games by players.

Characteristic	Energy Rummy	Calendar	Ring	Spiral
Interesting	Yes	Yes	Yes	Yes
Competition between players	Yes	Yes	Yes	Yes
Responses real	Yes	Yes	Yes	Yes
Playing pieces	Hard to read	OK	OK	OK
Time needed to play	OK	OK	OK	Too long
Clarity of rules	OK	OK	Confusing	Confusing
Challenge	OK	Too easy	Too easy	Too hard
Realism	Good	Too simple	Too complex	Too complex
Teaches about energy	No	Partly	Partly	Yes
Cooperation between players	None	None	Some	Some
Overall view	So-so	Good	Good	Too complex
Market price ($)	1.50	3.00	3.00	5.00

done on these particular designs, the project has enough potential and was met with enough enthusiasm by staff and the game players to warrant further development. Although other methods may be as effective as methods of information transfer, this approach offers a unique experience to both the players and the researcher in that it affords a light, informal atmosphere for the give-and-take of ideas. The approach enables all of those concerned to get actively involved in a potentially useful learning situation and quite possibly will reach segments of the population that will not be reached by other methods. The results were not as positive as we could have hoped for, but they certainly were not so negative that the project should be scrapped. Further development and refinement are necessary before a final decision on the value of the project is reached.

Energy Rummy, Calendar, Ring, and Spiral have a number of potential uses:

1. They can be incorporated into classroom activities beginning in elementary school to teach children, the fuel consumers of the future, the benefits of conservation.
2. They can be used in conjunction with traditional teaching methods in courses such as driver education.
3. It has been suggested that they could be reconstructed simply and cheaply as supplements in local newspapers and thus provide an inexpensive and entertaining means of educating the public to conservation measures.
4. Spiral has potential value as a policy research and analysis tool, to educate the policymaker to the ways in which consumers cope with constraints on energy, money, and mobility.

Overall, despite the fact that all of the games can stand improvements, they all warrant further refinement and development. Whether or not the difficulties encountered in these games can be worked out is not yet clear. Whether the purposes of this project could be better accomplished by other methods is also unclear at this point. What is clear is that the games need to be played more and possibly revised before any definite conclusions as to their value are established.

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