SCIENCE AND SCIENTISTS ON THE TV SCREEN; A PILOT STUDY[1]

By George Gerbner

While other industrial countries beef up their science education, and American science and engineering enrollments decline, most Americans encounter science every night on television. That encounter, however, does not come from scientists, educators, or even science programs. Science news and science programs are few and far between and most Americans avoid them. Even the most popular regular science program attracts only 7 to 10 percent of the viewing audience. While that may be over 5 million people, it is still far from being the major daily source of cultivation of public conceptions of and attitudes toward science. That source is general entertainment (mostly dramatic) programming, consuming the bulk of viewing time of those living in America's 75 million TV households.

The recent report of the U.S. Department of Education and the National Science Foundation to the White House warned of a "trend toward virtual scientific and technological illiteracy."[2] But illiteracy of any kind is no longer a question of cultural lack or lag. Every child and adult is exposed to more science-related material in dramatic form than any people in history. The question is, what kinds of conceptions and attitudes are cultivated by that massive discharge of vivid messages and images into the mainstream of the common symbolic enviornment? What contribution does television make to public understanding (or misunderstanding) of science? What are the consequences for the general cultural context

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[1]This paper is based on a larger report to the National Science Foundation entitled "Television's Contribution to Public Understanding of Science: A Pilot Study" by George Gerbner, Larry Gross, Michael Morgan, and Nancy Signorielli (Annenberg School of Communications, University of Pennsylvania, Philadelphia, PA 19104).

[2]"Science and Engineering Education for the 1980s and Beyond." Associated Press report, October 23, 1980.

in which science and technology develop, occuaptional choices are made, and informational efforts are conducted?

The purpose of our pilot project was to provide a preliminary assessment of that context and to suggest some answers to those questions. A more definitive account will have to await a broader study now in preparation.

The pilot project

This project was conducted as part of our ongoing research called Cultural Indicators. The research design consists of two interrelated parts: (1) message system analysis -- monitoring the world of television and (2) cultivation analysis -- determining the conceptions of social reality that television tends to cultivate in different groups of viewers.

Message systems analysis begins by selecting an annual week-long sample of prime-time (8-11 p.m. EST) and weekend-daytime (8 a.m. to 2 p.m. on Saturday and Sunday) network dramatic programming. Each program in the sample is videotaped, logged and placed in the video tape archive. Message analysis data are generated each year by analyzing each of these programs according to an extensive recording instrument. In this data gathering phase of the research each program is coded by two independent pairs of trained observers who make detailed objective records about different aspects of program content. We have each program coded twice (by separate coder-pairs) so we can test the reliability of each item in the recording instrument. The program data come from 814 prime-time and 606 weekend-daytime dramatic network programs in the fall samples of each year from 1969 to 1979 and two samples in spring of 1975 and 1976. Data on 1833 prime time and 1144 weekend daytime characters come from samples

broadcast between 1973 and 1979.[3]

The cultivation analysis presented in this report comes from the General Social Survey of the National Opinion Research Center concerning respondents' confidence in the scientific community.[4]

Message system analysis

In media terms, science is bad news but good drama. Science news makes up about 1 percent of all news items (puzzles and horoscopes claim three times as much) and even that small percentage declined during 1970's.[5] On television however, science and technology themes appear consistently in about half of all dramatic network programs, and their frequency increased during the 1970's Themes of the supernatural and the occult on television were, in contrast to newspapers, about one-third as frequent as science.

More specifically, 6 out of 10 prime-time and 7 out of 10 weekend-daytime (children's) programs involve a theme or aspect of life explicity and unambiguously relating to science, technology or engineering (as we define "science"). As the average viewer spends 30 hours a week in front of the television set, and a third of that viewing is prime-time (8 to 11 p.m. EST) drama, at least one hour of each weekday evening's viewing includes programs that involve science. No other cultural or educational source comes near to the magniture of that exposure.

Science is the main theme and focus of 4 percent of prime-time and 9

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[3]The character analysis is based on a smaller sample because the coding of discrete occupations was not incorporated into the instrument until 1973.

[4]A detailed account of methodology can be found in our Cultural Indicators reports, the most recent of which are: George Gerbner, Larry Gross, Nancy Signorielli, Michael Morgan and Marilyn Jackson-Beeck, "The Demonstration of Power: Violence Profile No. 10," Journal of Communication, Summer 1979, 29:3, 177-196, and George Gerbner, Larry Gross, Michael Morgan, and Nancy Signorielli, "The 'Mainstreaming' of America: Violence Provile No. 11," Journal of Communication, 1980, 30:3, 10-29.

[5]Clyde Z. Nunn, "Readership and Coverage of Science and Technology in Newspapers," Journalism Quarterly, 59:27-30, Spring 1979.

percent of weekend-daytime (children's) programs. The ranking of science on a list of 21 themes has been consistently in the first ten. The 11-year average places science 7th after the themes of sex, home, violence, business, money, and entertainment (in that order).

Nor is science limited to any particular genre, although it is slightly more frequent in serious and action dramas than in comedies. Consequently, it is also more likely to be associated with violence. There may also be a special affinity between science and violence on television: they occur together about 10 percent more frequently than either occurs by itself.

When science is a theme, the place of action is more likely to be outside the United States and/or in the future than when science is not involved. In fact, television drama has no "future" without science playing a significant role in it; every program placed in the future features science prominently. All strange locations in space and/or time account for about one-third of the science-related programs, suggesting the exotic and dangerous aspects of the dramatic image of science. Other themes most clearly related to science are those of nature (including natural disasters), affairs of state and the mass media, foreigners and minorities, illness, and drugs. Most of these mainifestations appear even more frequently and in more exaggerated forms in weekend-daytime (children's) programs.

Although science is a frequent theme of television drama, the scientist is a relatively rare and specialized dramatic character. The typical prime-time viewer encounters science and technology every night but a scientist only once a week, and a scientist playing a major role once every two weeks. Scientists comprise less than 1 percent of prime-time working characters. This proportion is less than half of the corresponding percentage in the U.S. labor force. (Women scientists as dramatic characters are, however, over-

represented on television compared to their tiny actual percentage in the country and to the small proportion of working women in the world of prime-time drama.) By comparison, doctors and other health professionals number over 7 times their real percentage of the population.

Underrepresentation in television drama means a sharply delineated and limited characterization and a relative restriction of the range of activities. Although positive portrayals outnumber negative, among the handful of scientists depicted fewer are youthful and involved in romance or family, and more are dangerous, and headed for ultimate failure, than are medical and other comparable professionals or the general character population. The scientists' aggregate personality profile, also generally positive, shows them, in comparison to health professionals and other characters, relatively less attractive, fair, sociable, warm, tall, young, or peaceful, but very smart. On weekend children's programs they were also judged to be less rational and stable and much more violent than other characters.

We know from our and other studies that living and learning in the world of television, as most Americans do, tends to cultivate certain conceptions of reality. What about science and scientists? The evidence, fragmentary and suggestive as it is, comes from some related investigations and our cultivation analysis.

Cultivation analysis

During the 70's there has been some change in the general public's level of confidence in the scientific community. Smith's[6] analysis of the National Opinion Research Corporation's (NORC) General Social Surveys from 1972 to 1978 revealed that the proportion of respondents who have expressed

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[6]Smith, Tom W. "A Compendium of trends on General Social Survey Questions." Chicago: National Opinion Research Corporation, Report N. 129, 1980.

"a great deal of confidence" (versus only some or hardly any) in the scientific community has shown an overall, though not steady, decline.

According to Etzioni and Nunn[7], who examined confidence in science from 1957 to 1973, the loss of support for science has occurred most among the politically weaker, less-informed, less-educated groups, but Nunn[8] argues that the public's image reflects not so much rejection as ambivalence.

Still, as noted by Mazur[9] and the National Science Foundation[10], while absolute levels of confidence in science may be declining, the relative ranking of science, compared to twelve other institutions, has actually improved; only medicine gets a higher confidence rating. Miller[11] also stresses the relatively favorable rating. Thus, it seems likely that, in overall terms, the public diminishing confidence in the scientific community is sympotomatic of loss of faith in most institutions. Relatively speaking, confidence in science may even have improved. But television did not enhance the image.

We have noted that, for large numbers of people, television drama is the primary or only source of information about science and scientists. Our preliminary analyses of General Social Survey (NORC) data suggests that the amount of television viewing may be negatively related to people's level of confidence in the scientific community, particularly among certain

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[7]Etzioni, Amitai and Clyde Nunn. "The Public Appreciation of Science in Contemporary America." Daedalus, 1974, 103, 191-205.

[8]Nunn, Clyde "Is There a Crisis of Confidence in Science?" Science, 1977, 198, 995.

[9]Mazur, Allan "Public Confidence in Science." Social Studies of Science, 1977, 7, 123-125.

[10]National Science Foundation: Science Indicators, 1976, Washington, GPO, 1977; "Science at the Bicentennial," Report of the National Science Board, Washington: GPO, 1977; and Science Indicators, 1974, Washington, GPO, 1975.

[11]Miller, Jon P. "The Impact of Two Decades of Space Explorat-on of the Development of American Attitudes Toward Science and Technology." Presented at the Conference on Retrospective Technology Assessment, Pittsburg, December, 1976.

groups of respondents.

Let us first look at the association between the amount of TV viewing and confidence in 13 major institutions. According to the simple bivariate patterns shown in Table 1, greater amounts of television viewing tend to go with expressing greater confidence in the people who run most social institutions. Of the 13 institutions rated by NORC respondents, heavy viewers are more likely than are light viewers to have "a great deal of confidence" in the people running 8 (and 7 of these relationships are significant).

Of all 13, only two show significant overall negative associations with viewing Major companies and the Scientific Community. The negative association between amount of viewing and confidence in the scientific community is particularly noteworthy given the fact that it is the second highest-rated institution. While the overall negative association between television viewing and confidence in science is not enormously powerful, it is monotonic and significant; 46 percent of light viewers, compared to 42 percent of medium viewers and 39 percent of heavy viewers, have "a great deal" of confidence in the scientific community ($p < .001$, tau).

This relationship takes on a variety of different and interesting forms within different subgroups of respondents. The baselines and the intensity of association manifest wide fluctuations across different groups. Some of these variations within-groups may be explained by a process we call "mainstreaming."[12] "Mainstreaming" implies that differences among groups deriving from other factors may be reduced or even disappear among heavy viewers. Groups who share the "mainstream" view (i.e., a relative commonality of outlooks cultivated by television) will often show no association between amount of viewing and a given outlook or perspective. But strong relationships may be found for those groups whose light viewers do not share that outlook. Thus, cultivation may often imply a convergence into a more homogenous "mainstream," rather than absolute, across-the-board increments.

Figure 1 presents a graphic illustration of the concept of "mainstreaming." It shows the relationship between amount of viewing and degree of confidence in the scientific community, broken down by respondents' age and income levels. We see that all viewers in certain subgroups -- older and lower-income respondents -- are much less likely than their counterparts to report having a great deal of confidence in science. They are already in the "mainstream." These groups show virtually no association between degree of confidence in science and amount of viewing. But other subgroups whose light viewers have more confidence in science -- younger, middle-aged, and middle-and higher-income respondents -- show negative, monotonic and significant associations, with viewing. Clearly, television brings them into the relatively mistrustful "mainstream."

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[12] See Gerbner et. al. 1980

The data for these and other key subgroups are shown in Table 2. This Table indicates that the pattern holds also in terms of race. Non-white light viewers are less likely to express confidence in the scientific community and non-white heavy viewers show no evidence of cultivation. For whites, on the other hand, heavy viewing goes with a decrease in the level of confidence in the scientific community.

This association is essentially the same for both males and females, although females have less confidence in science than do males at every viewing level. The relationship is stronger among occasional newspaper readers than it is among daily readers. Although the relationship remains negative and significant even for daily newspaper readers, it is possible that newspapers present a somewhat different image of science than does television, and that this alternative information diminishes TV cultivation.

Controlling for education reduces cultivation to small and non-significant proportions. But it would be a mistake to conclude that television viewing has no relationship with confidence in the scientific community after education is taken into account. On the contrary; multiple controls within the low and high education group reveal a number of specifications, persistant assocations and discrete instances of "mainstreaming."

Two of these are particularly noteworthy. Among college-educated respondents, the association between viewing and degree of confidence in science is negative, monotonic, and marginally significant for those between 18 and 29, females, and those with high incomes (See Table 3.) Two of these subgroups are among those with relatively high levels of confidence in science, as light viewer. They are out of the "mainstream," and consequently show stronger evidence of cultivation.

Thus, rather than pointing to spuriousness, education level leads to specifications of cultivation. Among those who did not attend college, the association remains negative and significant for those with medium incomes, those between 30 and 54 years old. In the non-college group, the younger, non-white and lower income respondents who are light viewers have the lowest confidence of all, yet they all show very slight positive and monotonic associations with TV viewing. Although these are non-significant, the trend is consistent with "mainstreaming". Heavy viewers in those groups with the highest levels of confidence in science tend to show evidence of the cultivation of a negative image, while heavy viewers in those groups with the lowest degree of confidence show slight signs of having a more confident perspective, show evidence of positive cultivation. Both groups of heavy viewers are in the relatively homogenous "mainstream."

One final comparison provides a particularly vivid illustration of this concept. We noted above that the relationship between viewing and confidence in the scientific community might be better understood in terms of the larger context of public confidence in other social institutions. It seems reasonable to suggest that the relationship between television viewing and confidence in science may be mediated by one's general degree of confidence in other institutions. Specifically, since (a) heavier viewing is often associated with higher institutional confidence; (b) heavier viewing is often associated with lesser confidence in science; and (c) higher confidence in science goes with higher general institutional confidence ($r = .36$, $p < .001$), then controlling for one's general orientation to a variety of social institutions should increase the negative association between viewing and confidence in the scientific community.

In order to assess this notion, we added up the confidence levels of all of the institutions rated by respondents except "science". These twelve items seem to form a reliable measure of general confidence; the internal homogeneity (measured by Cronbach's alpha) is a quite acceptable .77. We then divided the sample into those who scored low and high on this index and conducted our usual analysis of demographic subgroups.

We found that general level of confidence in institutions does make a large difference (see Table 4). Among those who have little confidence in the people running most institutions, there are almost no relationships between amount of viewing and confidence in the scientific community. While most of these relationships remain negative, only two are significant. Among those with more confidence in general, television viewing has strong, consistent and significant negative associations with confidence in science. In many cases, the subgroup with the most positive general orientation shows the strongest negative association (i.e., "mainstreaming"). Even subgroups who showed no overall relationship (e.g., older respondents, low income respondents) here reveal significant negative patterns.

In sum, these findings suggest that some of television's dubious imagery may be reflected in viewers' levels of confidence in the scientific community. Generally, the groups that tend to be the most mistrustful of science, those who are already in the TV "mainstream," show the least evidence of cultivation by the television image. In fact, viewing may actually improve excessively jaundiced and alienated outlooks on science. On the other hand, the groups on which public institutions depend most on support show the greatest indication of an association

between television viewing and less confidence in science. These are the younger, better educated, middle and higher income, and generally confident groups, those that generally provide the bulk of interest in and support for science. As long as members of this group watch little or no television, their confidence in the scientific community is the highest of all groups. But that confidence level declines among those members of these same groups who watch more television. The heavy viewers in the otherwise supportive group of the population join the television "mainstream" where the generally more mistrustful and alienated are found.

This pilot study has found reasons for concern and for futher investigation into images of science and viewers' understanding of scinece. Television is the "wholesaler" of most images, including science. The image of science, although mostly benign, is linked with future, fantasy, and danger. The image of the scientist, although again largely positive, is a relatively rare, limited, and -- compared to other characters -- a strange and forbidding image. Steady exposure to these images confirms the suspicion and mistrust of those who already harbor such feelings. However, the most positively inclined groups in the population appear to be the most susceptible to the relatively negative images they see on television. Television, on the whole, seems to make few friends for science but may confuse and alienate its potentially most likely students and supporters. We may have a serious national problem standing in the way of better understanding and support of science, a problem that merits further, broader, and more definitive investigation.

TABLE 1

Percent of Respondents Expressing a "Great Deal" of Confidence in the People Running Various Institutions, by Amount of Television Viewing[1]

	TOTAL		TV Viewing: Light		Medium		Heavy		CD[2]	GAMMA	BASE N
	%	(N)	%	(N)	%	(N)	%	(N)			
Medicine	50	(2231)	47	(508)	51	(1042)	51	(681)	+4	.05*	4475
Scientific Community	42	(1734)	46	(466)	42	(803)	39	(465)	-7	-.09***	4123
Banks and Finance	36	(1614)	35	(376)	37	(761)	36	(477)	+1	.02	4437
Military	35	(1525)	30	(315)	36	(730)	37	(480)	+7	.09***	4356
Education	34	(1511)	32	(351)	33	(678)	36	(482)	+4	.06*	4466
Supreme Court	33	(1426)	32	(340)	34	(680)	32	(406)	0	-.01	4327
Organized Religion	33	(1436)	29	(307)	34	(675)	36	(454)	+7	.09***	4322
The Press	24	(1042)	22	(239)	23	(468)	26	(335)	+4	.06*	4423
Major Companies	24	(1029)	28	(299)	24	(484)	20	(246)	-8	-.15***	4314
Executive Branch of Government	19	(813)	19	(197)	19	(386)	18	(230)	-1	-.02	4392
Congress	16	(683)	15	(158)	15	(310)	17	(215)	+2	.04	4389
Television	17	(740)	11	(117)	16	(319)	23	(304)	+12	.27***	4438
Organized Labor	13	(542)	11	(112)	12	(233)	16	(197)	+5	.13***	4296

[1] Data Base = NORC General Social Surveys, 1975, 1977, 1978

[2] CD = Cultivation Differential; % heavy viewers with a great deal of confidence minus % light viewers with a great deal of confidence

* $p < .05$ (tau)

** $p < .01$ (tau)

*** $p < .001$ (tau)

TABLE 2

Relationship Between Amount of Television Viewing and Level of Confidence in the Scientific Community

	TOTAL		TV VIEWING: Light		Medium		Heavy		CD[1]	GAMMA	BASE N
	%	(N)	%	(N)	%	(N)	%	(N)			
Overall	42	(1734)	46	(466)	42	(803)	39	(465)	-7	-0.9***	4123
Controlling for:											
Age											
18-29	42	(473)	47	(113)	42	(202)	40	(158)	-7	-.09*	1116
30-54	43	(796)	49	(256)	43	(383)	38	(157)	-11	-.14***	1833
over 55	39	(456)	39	(94)	41	(215)	38	(147)	-1	-.02	1157
Income											
under $10,000	38	(544)	38	(111)	37	(218)	38	(215)	0	.01	1448
$10,000 - $25,000	44	(828)	49	(234)	43	(402)	39	(192)	-10	-.12***	1900
over $25,000	51	(268)	54	(99)	51	(136)	46	(33)	-8	-.08	526
Newspaper											
Daily	44	(1141)	47	(290)	44	(550)	42	(301)	-5	-.06*	2578
Sometimes	39	(593)	44	(178)	39	(253)	34	(164)	-10	-.14***	1542
Education											
No College	37	(1037)	39	(215)	38	(472)	36	(350)	-3	-.04	2770
Some College	52	(693)	54	(250)	51	(330)	49	(113)	-5	-.06	1341
Sex											
Male	46	(861)	49	(252)	46	(419)	42	(190)	-7	-.08*	1864
Female	39	(873)	43	(214)	38	(384)	37	(275)	-6	-.08*	2259
Race											
White	44	(1589)	48	(442)	43	(742)	41	(405)	-7	-.09***	3654
Non-White	31	(145)	29	(24)	33	(61)	30	(60)	+1	-.01	469

[1] CD = Cultivation Differential; % heavy viewers with a great deal of confidence minus % light viewers with a great deal of confidence

* $p < .05$ (tau)

** $p < .01$ (tau)

*** $p < .001$ (tau)

TABLE 3

Relationship Between Amount of Television Viewing and Level of Confidence in the Scientific Community Controlling for Education

	No College			Some College		
	%L[1]	CD[2]	GAMMA	%L[1]	CD[2]	GAMMA
Overall	39	-3	-.04	54	-5	-.06
Controlling for:						
Age						
18-29	36	+2	.02	56	-10	-.11#
30-54	43	-8	-.11**	55	-4	-.06
55 and over	35	+1	.01	48	+2	.04
Sex						
Male	40	-2	-.04	58	+2	-.00
Female	38	-3	-.03	49	-7	-.09#
Income						
under $10,000	33	+3	.04	50	+4	.04
$10,000 - $25,000	44	-7	-.09*	53	-6	-.06
over $25,000	42	+2	.03	60	-10	-.14#
Race						
White	41	-2	-.04	55	-2	-.04
Non-White	26	+3	.03	35	-2	-.09

[1] %L = light viewers with a great deal of confidence in scientific community

[2] CD = Cultivation Differential; % heavy viewers with a great deal of confidence minus % light viewers with a great deal of confidence

*$p < .05$ (tau)

**$p < .01$ (tau)

#$p < .10$ (tau)

TABLE 4

Relationship Between Amount of Television Viewing and Level of Confidence in the Scientific Community Controlling for General Institutional Confidence

	Low Overall Confidence			High Overall Confidence		
	%L[1]	CD[2]	GAMMA	%L[1]	CD[2]	GAMMA
Overall	28	-5	-.07*	65	-14	-.18***
Controlling for:						
Education						
No College	21	0	.01	59	-11	-.13***
Some College	36	-4	-.06	73	-8	-.12*
Age						
18-29	28	-3	-.05	65	-11	-.13*
30-54	30	-7	-.12*	69	-18	-.22***
55 and over	22	-2	-.03	57	-9	-.13*
Sex						
Male	27	-2	-.02	71	-17	-.22***
Female	29	-7	-.09#	59	-10	-.13**
Income						
under $10,000	20	+2	.07	59	-9	-.11*
$10,000 - $25,000	30	-5	-.08	66	-13	-.17***
over $25,000	35	-6	-.07	71	-14	-.17#
Race						
White	29	-4	-.07	66	-13	-.17***
Non-White	14	+1	.09	49	-8	-.13
Newspaper Reading						
Everyday	30	-3	-.06	64	-10	-.12**
Sometimes	24	-6	-.10#	67	-21	-.26***

[1] %L = light viewers with a great deal of confidence in scientific community

[2] CD = Cultivation Differential; % heavy viewers with a great deal of confidence minus % light viewers with a great deal of confidence

*p < .05 (tau)

**p < .01 (tau)

***p < .001 (tau)

#p < .10 (tau)

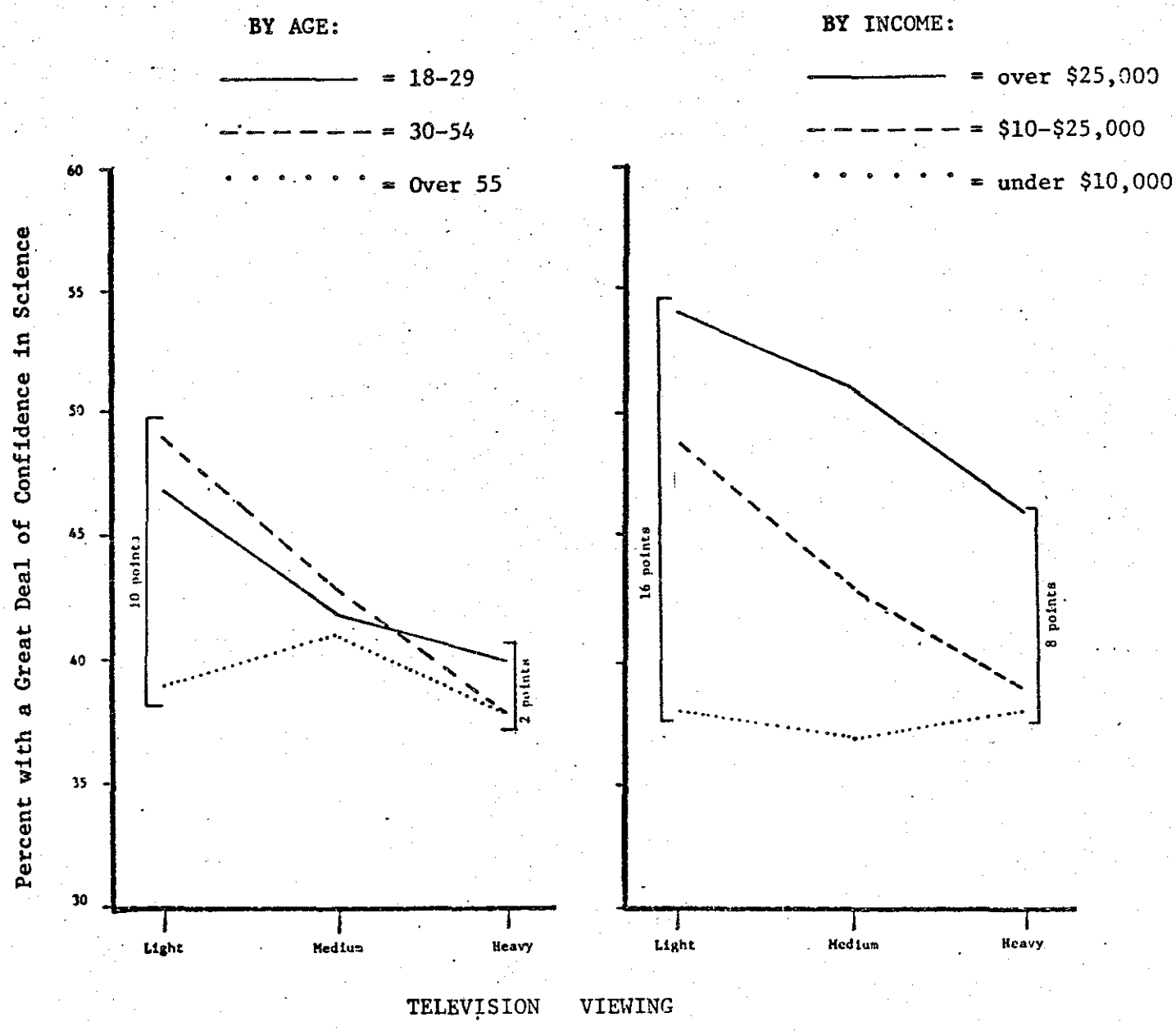

Figure 1

Graphic Depiction of "Mainstreaming": The Relationship between Amount of Television Viewing and Degree of Confidence in the Scientific Community, within Age and Income Groups