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THE INTEGRATION OF ENTERTAINMENT AND COMMUNICATION TECHNOLOGIES WITHIN HOME ENVIRONMENTS

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Abstract

Content analysis was used to determine if the integration of entertainment and communications technology in the home environment has changed over the last seven decades. Observations for this study were taken from illustrations of home interiors in House and Garden magazine from 1918 through 1987. An integration score was developed based on how well the styles of the technology and the furnishings matched, on seating arrangements relative to the technology, and whether the technology was concealed. The research indicated that integration of technology into home interiors significantly improved ($p<.05$) over the 70-year period. Changes in integration scores were caused by style changes, the diminishing size of the technological equipment, and increased level of technology use in the home. The process of integrating was easiest for small items. The ability of designers to successfully integrate technology into the home may imply reduced levels of stress on the lives of occupants.

Introduction

In 1987, over 30 billion dollars were spent in the United States on entertainment and communications equipment for the home (Electronic Industries Association, 1988). Merchandizing Week reported that by 1963 almost 98 percent of American households owned at least one radio (Neritin, 1972). By 1966, the same percentage of households owned at least one television (Neritin, 1972). But what have been the repercussions on home interiors and the psychological well being of their inhabitants?

The changes also have a social component. According to Pytlik, Lauda, and Johnson (1978), technological changes are almost always accompanied by social changes. Teich (1972) showed how the subsequent social changes occur globally as well as at a personal level. He also stated that technological change has relieved the human preoccupation with physical needs, eroded family values and individualism, and changed household activities.

Changes in interior design due to technology are numerous and varied. Yet, empirical research on technology-based changes in the home and among its inhabitants is almost nonexistent (Bryant, 1987). The author conducted a historical analysis of the integration of the phonograph, radio, and television into home interiors. In addition, she examines the implications of technological integration to environmental stress within the home. The study period is from 1918 through 1987.

Literature Review

Nattrass and Morrison (1977) described humans as dependent upon their built environment for fulfilling basic physical and psychological needs. Therefore, the built environment, including technological furnishings, can either satisfy or frustrate attempts to meet these needs. Improper placement and design of a technology may at first appear to be inconsequential. However, the repeated use of numerous pieces of poorly integrated equipment can contribute to environmental stress (Baum, Singer, and Baum, 1982).

Evans, Cohen, and Brennan (1986) identified ten factors of the built environment that can affect the level of environmental stress. Five of these factors relate directly to

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entertainment and communications technology. For this study, these five factors are used as a basis to examine integration of the phonograph, radio, and television in the home. The five factors are: rapid changes and disruptions in the physical setting; lack of control; diversity; interior design and elicited behavior; and lack of privacy.

Rapid changes and disruptions in the physical setting

Many new technological devices have arrived in the market place rather suddenly. Little time has been devoted to their proper placement within the home, congruence with existing furnishing styles, or how this new technology might affect room arrangement and existing room activities. This phenomenon, in which part of a culture changes before or to a greater degree than other parts, has been described by Ogburn (1964) as cultural lag. The rapidity of change was described by Halley and Vatter (1975) as having a snowball effect. They saw technology and science as the prime motivator, literally dragging society into the future. A combination of rapid technological development and cultural lag suggests that for this century the level of integration of technological equipment within the home might be quite low.

Lack of control

With new technological advances arriving faster than they can be easily assimilated, the question arises: are we in control of technology or is it in control of us? Technological determinists have proclaimed a need for more societal guidance based on rational analysis for efficient acceptance of technologies (Hughes, 1975). Pytlik, Lauda, and Johnson (1975) claimed that unchecked submission to a technological society entails an erosion of selfhood.

The internal conflict of "man versus machine" was first identified in the late 1800s when machines were used to perform work that had previously been done by hand. And though machines increasingly dehumanized the workplace, technology had very little impact on the home or on leisure time (Clark, 1986).

Technology first entered the home as labor-saving devices in the kitchen and laundry. By the 1920s it became a part of leisure-time activities through radios and phonographs. Popular acceptance of television in the 1950s completed the transition. The consumer's role changed from that of participant to spectator as technology supplied the entertainment. McLuhan (1964) described this willingness to submit to technology as "autoamputation" and predicted that it could lead to behavioral unconsciousness or apathy.

Entertainment technology is an important feature in many homes today. Family rooms are planned around placement of the television. Bedrooms are designed to accommodate stereo systems. Technological equipment often plays a role in family decisions.

Diversity

American consumers continue to acquire technological devices despite social concern over repercussions. Sociotechnologists have identified this condition as an ongoing process of accommodation (Teich, 1972). Mesthene (1972) stated that technology has a direct impact on values by creating new opportunities. This mechanism alters social organization and, ultimately, makes it more difficult to achieve goals through established social structure.

Concrete examples of this phenomenon exist in interior design. The introduction of television, for example, created new leisure-time opportunities at home. It also interrupted previously established, social patterns. Arrangements that improved television viewing may have often had a negative effect upon other functions, conversation groupings, or access to a piano. Such circumstances can contribute to stress. Ryan (1969) identified two types of tensions that may occur when a new technology is introduced: functional disequilibria and logical or meaningful disequilibria.

Functional disequilibria occur when the mechanical innovation is misused or does not fit into existing social habits. Hiding the entertainment equipment because it does not fit the style of the interior is an example. Logical or meaningful disequilibria occur when the technology requires changes in ideological or psychological mechanisms.

Having to leave a computer exposed in a traditional setting may cause tensions in those who are very style-conscious. In either case integration of the technical equipment is incomplete because of the conflicting styles, the diversities.

Interior design and elicited behavior

The style and arrangement of furniture, its colors, textures, and forms convey information that influences how we feel. It also conveys information regarding the behavior appropriate within a space (Denton, 1977).

During the Victorian era (1880-1920), for example, houses conveyed a standardized message of repose, refuge from excitement, and a return to nature (Clark, 1986). The home was seen as the central factor in achieving the "perfect family" (Clark, 1986).

Toward the end of the Victorian period, labor-saving technologies were devised for the kitchen and laundry. According to Cowan (1973), these new conveniences made work less difficult but diminished the traditional domestic symbols of hearth and home. Nonetheless, the living room or parlor remained the public room and maintained the traditional message of home. This made integration of the radio and phonograph more intrusive. Moreover, because technical equipment did not match traditional furnishings it was often concealed in cabinets. This not only impeded use but interfered with the clear conveyance of information regarding appropriate behavior within the room.

The arrival and acceptance of "modern" furniture in the 1930s afforded people the option of matching technology and furnishings. There remained a strong tradition that furniture arrangement be understandable to the general public (Wright, 1981). Once again the integration of technology was tempered by the need to communicate traditional use of the space.

Lack of privacy

The need for privacy was identified during the late 1890s as people moved to the suburbs to escape crowded cities. The house, seen as a refuge from the world (Clark, 1986), satisfied this need for privacy.

Many forms of entertainment and communications technologies intrude on privacy. According to McLuhan (1964), a telephone ring creates an immediate tension. In addition, radio and television offer a nonstop source of news and information. Once accustomed to this source of input, one may feel something is missing when it is removed. Given this scenario, privacy problems are common in family situations. One individual wants to listen to the radio or watch television while others do not. Today's concept of "getting away from it all" often means taking a break from the telephone, television, and radio. The house, with all its electronic devices connecting us to the rest of the world, is not always a place of refuge.

To summarize, the integration of technology into daily life has generated environmental stress as a byproduct. This stress is created when existing social habits and aesthetics are displaced or infringed upon by technological innovation. Literature in this review implies three indicators for measuring the level of integration of a technological innovation within an interior environment:

1) style-match of the technology with the interior furnishings
2) the arrangement of the furniture for efficient use of the technology
3) open-display of the technology for efficient use.

Methodology

A content analysis was conducted on how communications and entertainment technologies were illustrated in *House and Garden* magazine from 1918 through 1987. *House and Garden* was chosen because of its continuous publication since 1894. In addition, it has been more concerned with homes and interiors than most other popular magazines.

Naturally, a magazine cannot reflect all possible home interiors. Additionally, some interiors may be altered for photographic purposes. However, the use of a "home magazine" for historical analysis has several advantages. Home magazines have been and

still are used by home owners as sources of design ideas (Wright 1981). Home magazines feature common design practices and idealized settings. Although all economic levels may not be able to afford designs featured in a particular magazine, an "ideal" look is promoted.

Data

Three researchers knowledgeable in interior design and historic furniture styles collected data for the content analysis. Every issue of *House and Garden* was examined from cover-to-cover over a publication period of 70 years. For every illustration containing either a radio, phonograph, or television, the following was noted: type and style of room and equipment; placement of the technology in the room; and whether the equipment was concealed. The number of observations within an issue and within a total year varied considerably. In all, 1,323 illustrations were used.

Analysis

From this information, observations were evaluated based upon three separate integration criteria:

Style-match: A piece of equipment was judged to exhibit a style-match if the equipment was traditional and the room interior was traditional, or the equipment was contemporary and the room was contemporary. Observations from rooms with a mixture of traditional and contemporary furniture were deleted. These deletions accounted for less than one percent of the total sample.

Positive-seating: This means there was seating in the room, and one could easily reach the equipment controls. In addition, positive-seating for television required sight of the screen. In work-related rooms such as the kitchen, adequate access to the controls and a view of the screen from work areas was required.

Open-display: Equipment was considered openly displayed if permanently visible in the room. Concealment took the form of closets, cabinets designed to disguise speakers, or doors to cover monitors and turntables.

All three technologies have changed considerably since their first introduction. For this study, any auxiliary piece used with the equipment such as separate speakers, video cassette recorder, or turntable was considered to be a part of the technology. Combinations such as radio-phonographs and television-radio consoles were counted as two pieces of equipment.

There are two independent variables: technology type and time period. Technology type is a class variable and can have three values: phonograph, radio, or television. Time period is a variable measured in ten-year increments beginning with the year 1918. For purposes of discussion, decades were named by the first year of the 10-year period. The first decade, spanning the period between 1918 and 1927, for example, is called decade 18.

Four dependent variables were used for this research. Three of these, style-match, positive-seating, and open-display, are components of the fourth dependent variable. This fourth variable is the arithmetic mean of the three component variables. An integration score, in percent, was calculated for each variable by magazine issue.

Percent scores rather than actual frequencies were used for this analysis because the number of observations differed greatly from issue to issue. Percent represents the ratio of the number of times the criteria occurred, divided by the number of illustrations of that technology in that issue. For example, if the January, 1972 issue had five illustrations showing positive-seating arrangements for television from a total of 20 illustrations of television, the positive-seating score for that month for television would be 25 percent. A score for the fourth dependent variable, combined integration, was then calculated per issue as the statistical mean of the three component integration scores.

Problem Definition

The problem statement can be framed by two questions. Has the integration of technology into homes changed significantly from one decade to another? Did the type of technology introduced make a difference in that level of integration?

Study Objectives

The study objectives are:

1. Were there significant *inter*decade differences among combined-integration scores across technology types?
2. Were there significant *intra*decade differences among combined-integration scores across technology types?
3. Were there significant *inter*decade differences among component-integration scores across technology types?
4. Were there significant *intra*decade differences among component-integration scores across technology types?

The data were analyzed using the Statistical Analysis System (SAS). Analysis of variance (ANOVA) and least-square means (LSM) comparisons were then performed to test significant differences among decades and technologies.

Findings

ANOVA indicates significance at $p<.05$ for all major effects and all but one interaction across the four independent variables. The one exception was for the component variable style-match where the interaction was not significant. The findings are shown in Tables 1 through 4.

Table 1. ANOVA for combined-integration score.

Independent Variable		DF	FP<F
Time period	6	4.55	0.0001
Technology type	2	42.16	0.0001
Time x technology	10	1.89	0.0421

Table 2. ANOVA for component-integration score.
Dependent variable: Style-match

Independent Variable	DF	F	P<F
Time period	6	5.01	0.0001
Technology type	2	8.08	0.0003
Time x technology*	10	1.61	0.0993*

*Not significant at P<0.05

Table 3. ANOVA for component-integration score.
Dependent variable: Positive-seating

Variable	DF	F	P<F
Time period	6	3.19	0.0042
Technology type	2	29.11	0.0001
Time x technology	10	1.93	0.0373

Table 4. ANOVA for component-integration score.
Dependent variable: Open-display

Independent Variable	DF	F	P<F
Time period	6	22.21	0.0001
Technology type	2	91.19	0.0001
Time x technology	10	8.34	0.0001

Interdecade comparisons of combined. In comparing one decade with another, two questions were of interest: 1) were there significant differences between combined integration scores of the first and last decades and, 2) were there significant differences among combined-integration scores within the seven-decade period? The results are reported in Table 5 and Figure1.

Table 5. Mean combined-integration scores by time period and technology type.

Technology	Decade						
type	18	28	38	48	58	68	78
Phonograph	64.84	71.73	57.97	67.95	65.04	68.44	79.08
Radio	80.21	83.95	77.85	84.26	83.16	87.75	85.68
Television			38.89	62.08	68.66	76.65	71.11

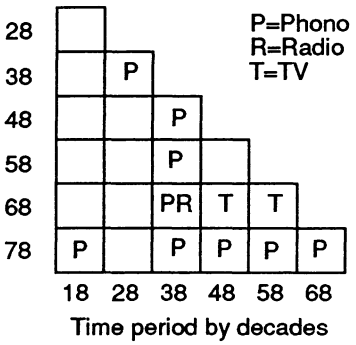

Figure 1. Interdecade-comparison matrix of *combined-integration* scores by technology type.*

*A letter at the intersection of two decades indicates there was a significant difference between interdecade scores for that particular piece of equipment.

Combined-integration scores for both the phonograph and television were significantly higher ($p<.05$) in decade 78 than in their decade of first use. This was not true for the radio.

Variability also occurred within the seven-decade period. Decade 38 exhibited significantly low combined-integration scores ($p<.05$) for all three technologies. Significant high combined-integration scores ($p<.05$) occurred in decade 68 for radio and television and in decade 78 for the phonograph.

Intradecade comparisons of combined. In examining differences among technologies within each decade, the analysis revealed that over the seven-decade period, the radio exhibited the highest and most consistent combined score. This is shown in Table 5 and Figure 2. Radio scores were significantly higher ($p<.05$) than phonograph scores for all decades but 78, and significantly higher than all television scores. By contrast, television and phonograph combined scores differed significantly from one another ($p<.05$) only in decades 68 and 78. In decade 68 television scores were higher and in decade 78 phonograph scores were higher.

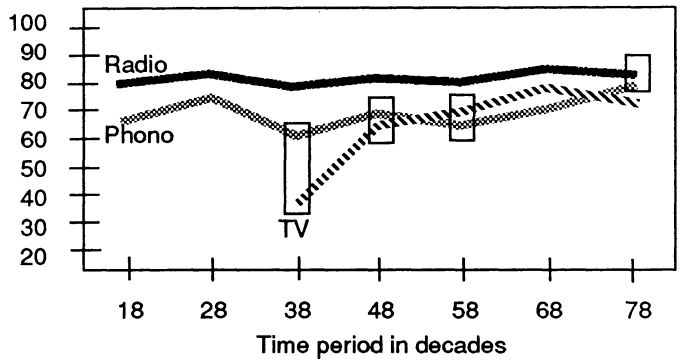

Figure 2. Combined-integration scores in percent by time period and technology type with intradecade comparisons.*

*Intradecade scores within a common box are not significantly different.

Interdecade comparisons by component. Analysis of the individual components of the combined-integration scores were conducted so as to better understand their relationship to the combined scores. Decade means and significant differences between decades are reported in Tables 6, 7, and 8 and in Figures 3, 4, and 5. Significant increases dating from the introduction of the technology to decade 78 occurred for all three dependent variables--style-match, positive-seating, and open-display--but not across all technologies.

From decade 18 to decade 78 style-match scores for all three technologies declined (Table 6) while open-display scores increased (Table 8). All of these changes were significant ($p<.05$) except for the radio style-match score. Only positive-seating scores increased significantly ($p<.05$) over the entire 70-year period (Table 7).

Table 6. Mean component-integration scores for style-match by time period and technology type.

Technology	Decade						
Type	18	28	38	48	58	68	78
Phonograph	100.00	90.00	90.65	95.71	84.48	86.47	69.44
Radio	75.00	90.74	76.57	72.84	70.33	78.29	68.75
Television				93.98	77.71	74.59	66.97

Table 7. Mean component-integration scores for positive-seating by time period and technology type.

Technology	Decade						
Type	18	28	38	48	58	68	78
Phonograph	52.38	80.00	79.92	79.96	62.07	76.64	76.50
Radio	81.75	89.58	77.81	86.19	75.27	74.32	83.33
Television				55.01	51.47	52.78	49.15

Table 8. Mean component-integration scores for open-display by time period and technology type.

Technology Type	Decade 18	28	38	48	58	68	78
Phonograph	62.55	66.96	20.10	39.51	57.82	60.61	83.76
Radio	76.39	76.62	77.81	90.01	94.41	100.00	94.53
Television				50.75	75.92	91.86	92.32

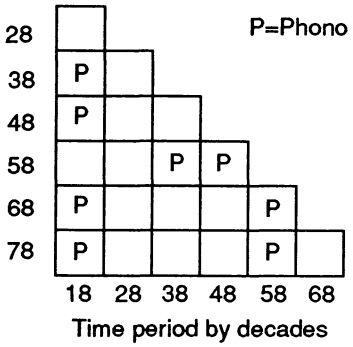

Figure 3. Interdecade-comparison matrix of *positive-seating* scores by technology type.*

Intradecade comparisons by component. Differences in component-integration scores among technologies also occurred within each decade. These results are summarized in Figures 6, 7, and 8. Means are the same as those reported in Tables 6, 7, and 8. Examination of these scores indicates whether a general design philosophy was developing to encompass all technologies or whether each technology was treated in a different way. The largest number of significant differences occurred during decades 48, 58, and 68 (see Tables 6, 7, and 8). By decade 78 only significant differences in positive-seating remained (see Table 7). This was due to low television scores.

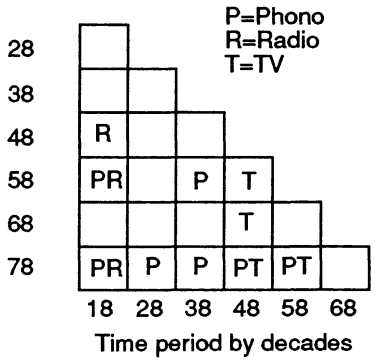

Figure 4. Interdecade-comparison matrix of *style-match* scores by technology type.

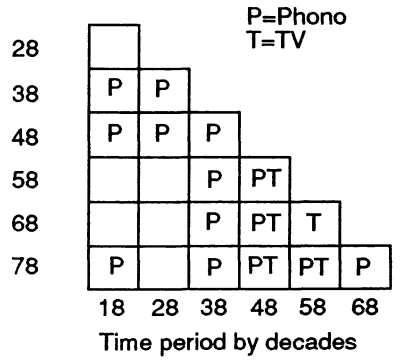

Figure 5. Interdecade-comparison matrix of *open-display* scores by technology type.

*A letter at the intersection of two decades indicates there was a significant difference between interdecade scores for that particular piece of equipment.

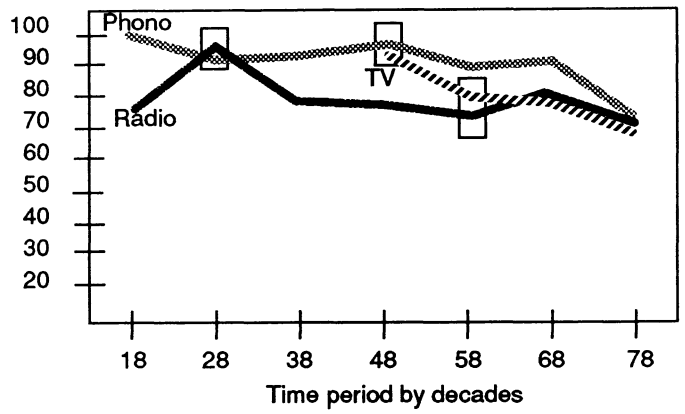

Figure 6. Integration scores in percent for the component *style-match* by time period and technology type with intradecade comparisons.*

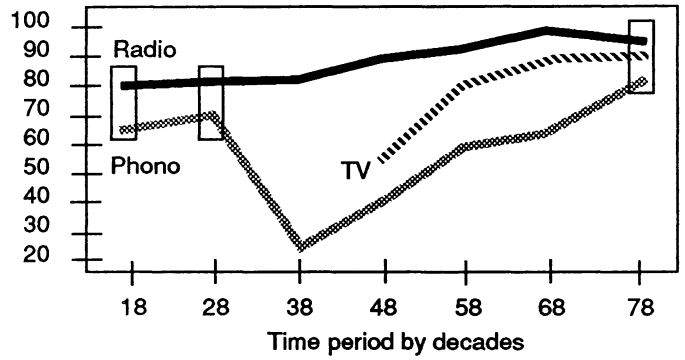

Figure 7. Integration scores in percent for the component *open-display* by time period and technology type with intradecade comparisons.*

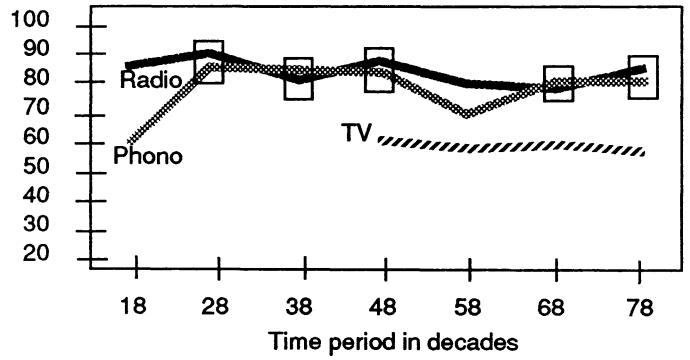

Figure 8. Integration scores in percent for the component *positive-seating* by time period and technology with intradecade comparisons.*

*Intradecade scores within a common box are not significantly different.

Discussion

According to the findings, all three technologies were more integrated in decade 78 than when first introduced. Higher scores in open-display for all three technologies accounted for the majority of the combined score increases.

Comparing illustrations from the 1920s and 1980s make this quite clear. During the 1920s most radios and all phonographs were concealed in furniture. By contrast, 1980s magazine illustrations depicted the high-tech look with exposed equipment.

While the open-display component increased over the 70-year period, the style-match scores decreased for all three technologies. During the 1920s and early 1930s, nearly all home interiors were traditional. All phonographs and 75 percent of the radios were housed in traditional cabinets. Smaller radios were placed in sleek art-deco cases accounting for the other 25 percent. By the 1960s, major changes in style-match occurred due to the popularity of portable equipment. Magazine illustrations in the 1970s made it clear that overt representation of the equipment superseded style-match. Even formal, traditional rooms displayed contemporary-style, electronic equipment.

The fact that combined scores improved due to the open display component rather than the style-match component indicates a strong desire to design for practical, efficient use of the technology rather than a traditional style. Though the positive-seating component scores significantly improved for the phonograph and remained high for radio, it decreased for television. This contradicts the notion of designing for efficient use. However, the television must be viewed as well as heard. This makes positive-seating more difficult. It is the author's opinion that design solutions for the television, at least in *House and Garden* during the last ten years, have not been very practical. During decade 78 a small, portable television was often shown placed on a bookshelf with the assumption that the user could move it for convenient use.

Variability in combined scores over the 70-year period appeared to be tied to events that occurred in particular decades. There is no clear evidence from this study to indicate that the date of introduction of the technology had any effect on changes in integration scores. Low scores in the open-display and positive-seating components during decade 38 can be explained by the introduction of the modern style.

Magazine illustrations during this period depict the modern style with smooth clean lines that required large storage walls to conceal "the clutter." Similar to the 1980s entertainment centers, these storage walls provided special niches for radio, phonographs, televisions, and auxiliary pieces. Doors concealed the equipment when not in use. Television suffered during this period since initial designs treated it like the radio and phonograph. Not only was the equipment concealed, but positive-seating for television suffered since storage walls inhibited multiple viewing.

High scores for the open-display component in decade 68 were followed by low scores for the style-match component in decade 78. These can be explained by several factors. By 1967 the three technologies were in use in 98 percent of American households (Neritin, 1972). Hence, decade 68 was the first full decade of mature technology use. Introduction of increasingly smaller equipment made it possible during this decade for the technology to be present without extensively disturbing other interior design intentions. This characteristic was coupled with the advent of high-tech design which reflected widespread acceptance of a mechanized appearance.

The same high-tech style that prompted the increase in the open-display component in decade 68, prompted a drop in combined scores for radio and television in decade 78. The acceptance of the high-tech style even in formal, traditional settings caused the style-match component scores to decline. This led to an overall drop in combined scores.

Characteristics intrinsic to each type of equipment accounted for significant differences in combined-integration scores. During the 70-year period the radio exhibited the least amount of score variability. Conversely, it maintained a significantly higher combined score than both the phonograph and television for every decade but 78. This combined-integration score was composed of the lowest style-match component score

but the highest for seating and open-display components. Since the radio was the smallest and least complex of the three technologies, these results make sense. By appearances, the smaller the technology and the less interaction required between user and machine, the easier it was to integrate.

Though wide differences in design treatment existed among technologies during decades 48, 58, and 68, the only significant differences that remained in decade 78 were due to television's low positive-seating component score. This would seem to indicate the development of a common pattern for treatment of all three technologies.

Conclusions

Technology has become more integrated with interiors over the last 70 years. This is reflected primarily in the shift away from concealment of the equipment and improved seating for use of the phonograph and radio.

Changes in furniture styles; the diminished physical size of equipment due to electronic miniaturization; and the increased number of technological units in the home have caused variability in the level of integration of technology in home interiors over the 70-year period. Integration appeared easiest for those items that were small and required less interaction between the equipment and the user.

A movement toward common design principles was apparent during decade 78. This was demonstrated as differences between integration scores diminished for all components but positive-seating.

Implications

It is possible to make comparisons between the five environmental stress factors previously reviewed and the findings of this research. Rapid changes have occurred in the world of entertainment and communications technology. A general mean-integration score of over 72 percent indicates that some degree of cultural lag exists. Since an increase in combined-integration scores over the 70-year period did occur, one also could conclude that the "snowball effect" described by Halley and Vatter (1978) was not in operation.

High integration scores for the open-display component coupled with lower style-match component scores, however, does suggest that technology will exert a stronger influence on interior design. This move towards technological control does not appear to be planned. Variability in combined scores over the 70-year period indicates that there has been no particular set of individuals as described by Hughes (1975) that has controlled the integration of the equipment. Rather, a combination of events, including changes in furnishing styles, the diminished size of the technology, and household saturation of the technology have influenced the level of integration.

The findings also confirm that as long as traditional styles continue to be used in the home, there will be some diversity between the technology and the design of the room. When style-match component scores were high, open-display component scores were low; when open-display component scores increased, style-match component scores decreased. In rooms incorporating traditional designs, a high level of integration is not possible. Persons who feel that traditional furnishings best reflect their personality may find the inclusion of technology more stressful.

Perhaps the most critical factor in measuring the integration of technology is identification of appropriate behavior for an environment. Increased exposure of the technology has helped to improve identification of the available activities for the room. Despite this factor, there has been little change in established seating arrangements. In fact, since 1948 there has been a steady decrease in appropriate seating for television viewing.

Privacy is the most difficult factor to address. It seems at odds with complete integration. If concealment of the technology is viewed as a means to privacy the increase in the open-display component scores over the 70-year period indicates a decrease in privacy in the home.

The creation of new technologies for the home will continue. Computers and large-screen televisions are currently challenging home designers and pose their own unique integration problems. To develop a more harmonious home atmosphere, creative architectural and furnishing designs are needed. Ideally these will capture the philosophical spirit of the traditional while allowing users to benefit from the wide range of available technology. To facilitate integration of these technologies into the home, flexibility is needed in planning room-use and alternative areas are needed for privacy.

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