Consumers’ Demographic Characteristics, Cognitive Ages, and Innovativeness

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ABSTRACT - The purpose of this study is to investigate the role of cognitive age in relation to demographics and innovativeness. Results of this study suggest the mediational role of cognitive age. It signals not only the message of chronological age, but also the information of other demographic characteristics. Furthermore, it directly determines consumers’ adoption behaviors of high-tech products. Focusing on cognitive age, therefore, marketers can both efficiently and effectively segment their markets. Finally, marketers can create a younger cognitive age in consumers through enhanced communication marketing efforts. In this way, cognitive age can be transformed into a controllable strategic variable.

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ABSTRACT

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INTRODUCTION

Chronological age is commonly used in marketing and consumer behavior research. It is easily measured and is an objective and universal attribute (Settersten and Mayer 1997) that is used frequently (Barak and Schiffman 1981). Although chronological age exerts important influences on consumer behaviors, when used in age related research, it does not function well as a dependent variable (Barak and Schiffman 1981). People frequently perceive themselves to be younger or older than their chronological age and this “self-perceived or cognitive age” seems to influence people’s daily behaviors (Barak and Schiffman 1981). For this reason, chronological age is meaningless unless a specific social meaning to it is attached (Neugarten and Hagestad 1976). This leads to the suggestion of broadening the concept of age (Roscoe, LeClaire, and Schiffman 1977), and other age related concepts suggested in literatures. Examples include subjective age (Blau 1956; Peters 1971), personal age (Kastenbaum, Derbin, Sabatini, and Artt 1972), biological age (Jarvik 1975), social age (Rose 1972), projected age (Puglesi 1983), and cognitive age (Barak and Schiffman 1981). Cognitive, rather than chronological age, directly influences one’s attitude and behaviors. Wilkes (1992) found cognitive age to be associated with self-confidence, work-orientation, fashion interest, entertainment, and cultural activities.

Adopters of innovative products are usually younger and have higher educational and income levels (Rogers 1962). Innovation (Schiffman and Sherman 1991), younger age, higher income (Underhill and Cadwell 1983; Wilkes 1992) and education (Underhill and Cadwell 1983) are all related to cognitive age and it may play an important role. The purpose of this study is to investigate the role of cognitive age to demographics and innovativeness.

Concept and Measurement of Cognitive Age

Cognitive age refers to one’s perceived age (Barak and Schiffman 1981). It differs from chronological age in that a person may cognitively feel younger or older than s/he actually is. According to Stephens (1991), there are three different measures of cognitive age: single-item measure (simple categorical adjectives, e.g., Blau 1956; Underhill and Cadwell 1983), four-dimension measure (i.e., feel-age, look-age, do-age, and interest-age; Kastenbaum et al. 1972), and semantic differential measure (Guptill 1969; George, Mutran, and Pennybacker 1980). Of the three, four-dimension measure is the most straightforward to administer, analyze, and interpret (Stephens 1991). Although the term “cognitive age” was first used by Barak and Schiffman (1981), its operational definition came from the four dimensions of personal age used in Kastenbaum et al. (1972). Kastenbaum et al. (1972) asked respondents to give a precise age figure for each age dimension (Goldsmith and Heiens 1992). Barak and Schiffman (1981) revised Kastenbaum et al.’s (1972) measures into a decade matching format. Their sample was limited to age 55 and over, while Kastenbaum et al.’s (1972) sample spanned from 20 to 69 years of age. In this study, Kastenbaum et al.’s (1972) measure is used because the age range of our sample is consistent with theirs.

Studies about cognitive age have emerged since the early 1980s by Barak and his colleagues (e.g., Barak and Gould 1985; Barak and Schiffman 1981), although cognitive concepts of age can be traced back to the mid 1950’s in a study by Tuckman and Lorge (1954) (Underhill and Cadwell 1983). Related issues studied include construct assessment (e.g., Barak and Schiffman 1981), measure comparisons (e.g., Stephens 1991), comparisons with other age concepts (e.g., Barak and Gould 1985), antecedent variables of cognitive age (e.g., Chua, Cote, and Leong 1990), and the antecedent and consequence of cognitive age (e.g., Gwinner and Stephens 2001; Wilkes 1992). Demographic variables (Gwinner and Stephens 2001; Wilkes 1992), life satisfaction, activity level, family life, health, culture (Chua et al. 1990), social support, and attitude toward the elderly (Gwinner and Stephens 2001) had all been treated as antecedent variables affecting cognitive age. Consequence variables include fashion interest, social involvement, self-confidence, work orientation (Wilkes 1992), information-seeking behavior, caution in purchases, and exploratory shopping behavior (Gwinner and Stephens 2001). The current study is devoted to exploring the role of cognitive age in relation to demographic characteristics and innovativeness, as innovative products play a key role in building and promoting the quality of consumers’ lives.

Two concepts concerning the adoption behavior of innovative products should be noted: (1) anxiety (2) information-seeking behavior. Innovation is uncertain and involves risks (Gatignon and Robertson 1985). Consumers may search for information about innovative products in order to reduce their risk anxiety (Taylor 1974). It is therefore necessary to include anxiety and its resulting information-seeking behavior in order to understand the relationship of cognitive age to the adoption behavior of innovative products. Our focus is on technological products, such as PCs, notebooks, mobile phones, Internet services and other related products, etc. We will, hereafter, use the more specific terms “technology anxiety” and “information-seeking behavior of high-tech products.”

Demographic Characteristics and Cognitive Age

Self-perceived ages vary. Teens tend to perceive themselves as older; young adults perceive themselves accurately; older people perceive themselves as younger (Montepare and Lachman 1989). Younger age identification among the elderly is even more obvious (Blau 1956; Peters 1971). The empirical findings of Bei and Chiao (2003) showed similar patterns in the gap between chronological

1The author would like to thank the Eastern Advertising Ltd. in Taiwan for offering the data bank (Eastern Integrated Consumer Profile) and Dr. Lien-Ti Bei for providing helpful suggestions in conducting this research. The author was a doctoral candidate of Business Administration Department of National Chengchi University when this paper was accepted and presented at the ACR Conference.
age and cognitive age. On average, cognitive corresponds to chronological age. The cognitive age of an older person will be higher than that of a younger person (Bei and Chiao 2003; Blau 1956; Peters 1971; Underhill and Cadwell 1983; Wilkes 1992).

**H1**: Consumers’ chronological age is positively related to cognitive age.

Men and women the same age may differ in cognitive age due to different psychological traits. Women are more sensitive to aging than men (Peters 1971), and thus tend to feel cognitively younger than their male counterparts.

**H2**: Cognitive age of female consumers is younger than that of males.

Education not only makes people more competent in the workplace, but also more self-confident and cognitively younger than the less educated (Bei and Chiao 2003; Underhill and Cadwell 1983).

**H3**: Consumers’ level of education is negatively related to cognitive age.

Cognitive age between singles and married was found to be contradictory in literatures at first glance. According to Underhill and Cadwell (1983) and Wilkes (1992), cognitive age of the married is younger than the single (or non-married), contrary to Bei and Chiao’s (2003) finding that the single feels cognitively younger than the married. The different findings may be attributed to the different categorization of the divorced or separated into separate levels or the single level. Bei and Chiao (2003) treated the divorced or separated as a distinct level of marital status, resulting in three levels, that is, the single, the divorced or separated, and the married. Other researches (Underhill and Cadwell 1983; Wilkes 1992) distinguished marital status into only two levels, that is, the single (or non-married) and the married, with the divorced or separated incorporated into the single level as arranged by Barak and Stern (1985), in which the non-married group included both never-married and formerly married.

Bei and Chiao (2003) found that the cognitive age of the single is younger than that of the married, and the cognitive age of the married is in turn younger than that of the divorced or separated. If this finding is true, then it is reasonable that Underhill and Cadwell (1983) and Wilkes (1992) both found the married cognitively younger than the single as a result of categorizing the divorced or separated into the single level, making the single cognitively older than the married. This article adopts the two-level categorization method, that is, the married and non-married with the latter including both the single and the divorced or separated. According to Bei and Chiao’s (2003) findings and considering the fact that the divorce rate in Taiwan is lower than the West, we hypothesize that the non-married, dominated by the single, is cognitively younger than the married.

**H4**: Non-married consumers’ cognitive age is younger than that of the married.

Individuals with a higher income enjoy higher socioeconomic status and higher life satisfaction and tend to feel younger. Previous studies show a similar viewpoint (Gwinner and Stephens 2001; Underhill and Cadwell 1983; Wilkes 1992).

**H5**: Consumers’ level of income is negatively related to their cognitive age.

Employed consumers reported feeling younger than retired ones (Underhill and Cadwell 1983), expressing more youthful vitality, as contrasted with the unemployed.

**H6**: Employed consumers’ cognitive age is younger than the unemployed.

**Cognitive Age and the Adoption Behavior of Innovative Products**

Technology anxiety comes from two sources: the risky nature of innovative products (Gatignon and Robertson 1985; Taylor 1974), and “macro consumer behavior” concern (termned by Belk and Pollay 1985; hereafter referred to as macro effect) about the negative side effect of innovative products on people and society. Regarding the latter, Belk and Pollay (1985) concluded that advertising has changed consumption values from “doing” (or instrumental materialism) to “having” (or terminal materialism) by “increasingly portray[ing] consumption as an end in itself rather than as a means to consumer well-being” (p. 887). This concern becomes more serious in the Internet era today. High-tech products, such as Internet service, speed up the macro effects of advertising and deteriorate consumption values from utilitarian values to hedonistic values; pleasure-seeking rather than deprivation avoidance (Tse, Belk, and Zhou 1989). The short life cycle of high-tech products makes the situation more serious. Concern about the negative side effect of innovative products on people and society becomes a more important source of anxiety when using high-tech products.

In regard to risks and the macro effect in the use of high-tech products, technology anxiety will incur in the consumers’ mind (Taylor 1974), and younger persons will suffer greater anxiety (Drentea 2000). Although the age used in Drentea (2000) is chronological age, it should be noted that the linkage between cognitive age and anxiety could be stronger and more direct than that between chronological age and anxiety, because cognitive age and anxiety are both psychological states. This provides indirect evidence for the negative relationship of cognitive age and technology anxiety.

**H7**: Consumers’ cognitive age is negatively related to technology anxiety.

Focusing on new brand trial behavior, Gwinner and Stephens (2001) found that cognitive age is negatively associated with information-seeking behavior, that is, the cognitively younger person conducts more information searching behaviors.

**H8**: Consumers’ cognitive age is negatively correlated with their information-seeking behavior of high-tech products.

Finally, those with a younger cognitive age tend to be more innovative (Schiffman and Sherman 1991), and will exhibit a higher degree of adopting high-tech products (Rogers 1962).

**H9**: Consumers’ cognitive age is negatively related to their adoption behavior of high-tech products.
Related Variables of the Adoption Behavior of Innovative Products

The uncertainty and macro effect of purchasing decisions may cause consumers to feel anxious about their choices (Taylor 1974). They will seek information to release anxiety (Roselius 1971). Because innovation per se brings about uncertainty (Gatignon and Robertson 1985), the adoption behavior of high-tech products is relatively risky. Therefore, consumers must search for more information to decide whether to adopt high-tech products or not.

H10: Consumers’ technology anxiety is positively related to their information-seeking behavior of high-tech products.

Anxiety is a psychological state of negative affect, whereas technology anxiety is a negative attitude towards high-tech products. Because consumer behavior can be directly influenced by attitudes (Bentler and Speckart 1979), the greater the technology anxiety, the lower the degree of adoption behavior of high-tech products.

H11: Consumers’ technology anxiety is negatively related to their adoption behavior of high-tech products.

Gwinner and Stephens (2001) showed that information-seeking behavior is one of the determinants of consumers’ new brand trial behavior. New brand trial, in nature, is one kind of risky behavior, and interest in new brand trial means a higher degree of innovativeness. Therefore, the more the information-seeking behavior, the greater will be the degree of adoption behavior of high-tech products (Rogers 1962).

H12: Consumers’ information-seeking behavior of high-tech products is positively related to their adoption behavior of high-tech products.

METHODOLOGY

Data Set and Sample

The data is from the database of the 2003 Eastern Integrated Consumer Profile (hereinafter referred to as E-ICP) set up by the Eastern Advertising Company. The Eastern Advertising Company has conducted a consumer survey in Taiwan every year since 1986 by means of a face-to-face in-house interview plus a self-entry form. The target age group in the E-ICP is between 13 and 64, with a sample size of 1344. Because large differences may exist between teens younger than 20 and adults over 20 in regard to cognitive age (Bei and Chiao 2003) and opinions about high-tech products, the sample used in this study is limited to adults over 20 years old. The data was analyzed using LISREL VIII (Jöreskog and Sörbom 1993). Chronological age, gender, educational level, marital status, income level, and employment status are not abstract concepts, are easy to measure, and are commonly used like an ID number. The measurement error of each demographic variable is nearly zero and thus it is reasonable to constrain their error terms to zero in the full model. Given that some exogenous variables are measured at nominal levels and the test of multivariate normality shows that the data are not multivariate normal, a WLS (Weighted Least Squares) estimation method was employed. Bollen (1989) accentuated the importance of cross-validation whenever the sample was sufficiently large. Following Bollen’s suggestion, this study randomly split the sample of 1119 data with an age over 20 into two subsamples of 560 and 559 data. The first one was used as a calibration sample for exploratory CFA, and the second as a validation sample.

Measurements

Multiple items were employed to measure all constructs, except for demographic variables. Cognitive age was measured by four dimensions suggested by Kastenbaum et al. (1972): feel-age, look-age, do-age, and interest-age in the form of open-ended questions. Respondents directly provided their perceptions of these four items of cognitive age. A set of seventeen items related to consumers’ technological lifestyles in the E-ICP. These items were first categorized into three constructs: technology anxiety, information-seeking behavior, and the adoption behavior of high-tech products, based on the meaning of each item and the outcome of EFA. Then, CFA was conducted using the calibration sample. In this stage, we deleted one item a time with the most serious cross-loadings based on the modification indices, while maintaining the content validity of each construct. After the most undesirable item was deleted, CFA and the deleting procedure were conducted again. The above screening procedure ran repeatedly until all modification indices and fit indices of the CFA model were satisfactory. The final items for each construct are listed in table 1, and the fit indices of the CFA model are referred in the calibration sample row of table 2.

The Measurement Model

The two-stage approach proposed by Anderson and Gerbing (1988) was adopted in this study. First, a CFA using the validation sample was conducted to validate the measurement model resulting from the calibration sample. Then, a full model was run to test the hypotheses. The fit indices of the CFA model using a validation sample were all acceptable and better than the generally accepted standards (see the validation sample row in table 2). As for reliability (see table 1), the composite reliabilities of constructs were all larger or equal to 0.77, better than the standard of 0.6 suggested by Bagozzi and Yi (1988). Furthermore, the variances extracted from the constructs (Fornell and Larcker 1981) were also acceptable; the extracted variances were all larger or equal to 0.53, better than the standard of 0.5 suggested by Bagozzi and Yi (1988). All loadings of variables (see table 3) were larger or equal to 0.67 with the significance level of $p < 0.001$, indicating the existence of convergent validity. Furthermore, the squared multiple correlations of variables (see table 1) were all larger or equal to 0.50 with the exception of the one for TA1. The average SMCs of each construct were all larger or equal to 0.54, indicating that most of the variances of variables can be explained by the latent constructs. With respect to discriminant validity, the most used criterion is to see whether the confidence interval of the correlation coefficient of two constructs includes 1. If the interval does not include 1, discriminant validity exists between the two constructs (Smith and Barclay 1997). Anderson (1987) suggested the range of correlation coefficient plus and minus 2 standard errors as the confidence interval. According to table 4, all the correlation coefficients between any two constructs plus and minus 2 standard errors do not include 1, indicating the existence of discriminant validity.

RESULTS

Testing the Mediation of Cognitive Age

A full model analysis was conducted in the second stage after assurance that the evaluation criteria of the measurement model were satisfactory. Dummy variable was used respectively for gender (1=female, 0=male), marital status (1=married, 0=single or divorced/separated), and employment status (1=employed, 0=unemployed). Following Garbarino and Johnson (1999), we tested for the mediational role of cognitive age by comparing the hypothesized mediating model with a less parsimonious nonmediational
rival model. In the rival model, all demographic variables (ex-ogenous variables) directly affect cognitive age and the three variables of the adoption behavior of high-tech products (endogenous variables) with no paths between the various endogenous variables. To find out which model is better, following Garbarino and Johnson (1999), we compared their fit to the following features: (1) overall fit statistics, (2) percentage of significant paths, and (3) parsimony of the model. First, the hypothesized model is better on all measures than the rival model (see Table 2). Second, the percentage of the significant paths in the hypothesized model (see Table 5) is larger than that of the rival model (83% versus 4%; the only significant path in the rival model is the one from chronological age to cognitive age $\gamma=0.88, t=25.47$). Finally, the hypothesized model is more parsimonious than the rival model (12 paths versus 24

### TABLE 1
Measurements of Variables

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Variables</th>
<th>Itemsa</th>
<th>CRb</th>
<th>VEb</th>
<th>SMCb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive age (CA)</td>
<td>CA1</td>
<td>How old do I feel like?</td>
<td>0.99</td>
<td>0.96</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>CA2</td>
<td>How old am I based on my ability to take action?</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CA3</td>
<td>How old do I look like?</td>
<td>0.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CA4</td>
<td>I am interested in things that are usually for people of what age?</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology anxiety</td>
<td>TA1</td>
<td>The development of technology makes people more and more alienated from each other.</td>
<td>0.77</td>
<td>0.53</td>
<td>0.46</td>
</tr>
<tr>
<td>(TA)</td>
<td>TA2</td>
<td>The newly developed high-tech products cause excessive material wants of people.</td>
<td></td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TA3</td>
<td>Depending on high-tech products too much is the main reason for weakness and over-pressure of modern people.</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information-seeking behavior of high-tech products (IS)</td>
<td>IS1</td>
<td>I often discuss and exchange information of newly developed high-tech products with my relatives and friends.</td>
<td>0.79</td>
<td>0.66</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>IS2</td>
<td>I often read reports on the news and in magazines about the information of newly developed technology.</td>
<td></td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Adoption behavior of high-tech products (AP)</td>
<td>AP1</td>
<td>I often search for information on the Internet.</td>
<td>0.88</td>
<td>0.79</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>AP2</td>
<td>It provides me with many opportunities to make friends on the Internet.</td>
<td></td>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>

a: All the items except for cognitive age are 6-point Likert scale.
b: Composite Reliability (CR), Variance Extracted (VE), and Squared Multiple Correlation (SMC) for validation sample.

### TABLE 2
Fit Indices for CFA Models and Structural Models

<table>
<thead>
<tr>
<th>Models</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>RMSEA</th>
<th>CFI</th>
<th>IFI</th>
<th>GFI</th>
<th>AGFI</th>
<th>PGFI</th>
<th>NFI</th>
<th>NNFI</th>
<th>PNFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFA Calibration sample</td>
<td>68.77</td>
<td>38</td>
<td>0.0016</td>
<td>0.038</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>Na.</td>
<td>1.00</td>
<td>1.00</td>
<td>Na.</td>
</tr>
<tr>
<td>Models Validation sample</td>
<td>46.40</td>
<td>38</td>
<td>0.16</td>
<td>0.020</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>Na.</td>
<td>1.00</td>
<td>1.00</td>
<td>Na.</td>
</tr>
<tr>
<td>Structural Hypothesized Model</td>
<td>212.52</td>
<td>98</td>
<td>0.00</td>
<td>0.046</td>
<td>0.95</td>
<td>0.95</td>
<td>1.00</td>
<td>0.64</td>
<td>0.91</td>
<td>0.93</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>Models Rival Model</td>
<td>254.13</td>
<td>86</td>
<td>0.00</td>
<td>0.059</td>
<td>0.92</td>
<td>0.92</td>
<td>1.00</td>
<td>1.00</td>
<td>0.56</td>
<td>0.89</td>
<td>0.87</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Na.: Not applicable. The measure is used in comparing alternative models.
TABLE 3
Validation CFA Model: Construct Loadings$^a$

<table>
<thead>
<tr>
<th>Variables</th>
<th>CA</th>
<th>TA</th>
<th>IS</th>
<th>AP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA1</td>
<td>0.98 (536.69)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA2</td>
<td>0.98 (464.66)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA3</td>
<td>0.99 (573.10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA4</td>
<td>0.98 (387.69)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TA1</td>
<td>0.67 (21.91)</td>
<td>0.81 (28.80)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TA2</td>
<td>0.70 (23.30)</td>
<td>0.70 (23.30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS1</td>
<td>0.81 (39.56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS2</td>
<td>0.82 (39.95)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AP1</td>
<td>0.91 (65.48)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AP2</td>
<td>0.87 (57.24)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$: T-values are in parentheses and all are significant at $p<.001$ levels.

TABLE 4
Correlation / Covariance Matrix$^a$

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>CA</th>
<th>TA</th>
<th>IS</th>
<th>AP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>35.45</td>
<td>10.82</td>
<td>116.80</td>
<td>-1.07</td>
<td>-5.05</td>
<td>-7.53</td>
</tr>
<tr>
<td>TA</td>
<td>3.85</td>
<td>1.14</td>
<td>0.84</td>
<td>0.35</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>2.88</td>
<td>1.17</td>
<td>-0.43</td>
<td>0.48</td>
<td>0.93</td>
<td>1.14</td>
</tr>
<tr>
<td>AP</td>
<td>2.63</td>
<td>1.32</td>
<td>-0.48</td>
<td>0.43</td>
<td>0.89</td>
<td>1.72</td>
</tr>
</tbody>
</table>

$^a$: Correlations are below the diagonal (standard errors are in parentheses), variances on the diagonal, and co-variances above the diagonal. T-values of correlations are all significant at $p<.001$ levels.

TABLE 5
Estimates of the Hypothesized Model

<table>
<thead>
<tr>
<th>Paths</th>
<th>Parameter Estimates</th>
<th>Standardized Parameter Estimates</th>
<th>T-values</th>
<th>Hypotheses Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronological age → CA</td>
<td>0.83</td>
<td>0.88</td>
<td>44.11***</td>
<td>H1 supported</td>
</tr>
<tr>
<td>Gender → CA</td>
<td>-1.09</td>
<td>-0.05</td>
<td>-4.01***</td>
<td>H2 supported</td>
</tr>
<tr>
<td>Educational level → CA</td>
<td>-1.18</td>
<td>-0.12</td>
<td>-7.60***</td>
<td>H3 supported</td>
</tr>
<tr>
<td>Marital status → CA</td>
<td>0.80</td>
<td>0.03</td>
<td>2.23*</td>
<td>H4 supported</td>
</tr>
<tr>
<td>Income level → CA</td>
<td>-0.26</td>
<td>-0.05</td>
<td>-2.52**</td>
<td>H5 supported</td>
</tr>
<tr>
<td>Employment status → CA</td>
<td>-0.49</td>
<td>-0.02</td>
<td>-1.13</td>
<td>H6 not supported</td>
</tr>
<tr>
<td>CA → TA</td>
<td>-0.01</td>
<td>-0.11</td>
<td>-2.40**</td>
<td>H7 supported</td>
</tr>
<tr>
<td>CA → IS</td>
<td>-0.04</td>
<td>-0.45</td>
<td>-11.28***</td>
<td>H8 supported</td>
</tr>
<tr>
<td>CA → AP</td>
<td>-0.02</td>
<td>-0.13</td>
<td>-3.76***</td>
<td>H9 supported</td>
</tr>
<tr>
<td>TA → IS</td>
<td>0.37</td>
<td>0.35</td>
<td>8.11***</td>
<td>H10 supported</td>
</tr>
<tr>
<td>TA → AP</td>
<td>0.06</td>
<td>0.04</td>
<td>1.14</td>
<td>H11 not supported</td>
</tr>
<tr>
<td>IS → AP</td>
<td>1.12</td>
<td>0.83</td>
<td>15.53***</td>
<td>H12 supported</td>
</tr>
</tbody>
</table>

Note: * denotes $p<.05$, ** denotes $p<.01$, *** denotes $p<.001$. Fit indices see table 2.
paths). In summary, the hypothesized model fits the data better than the rival model. We can reject the nonmediational rival model in favor of the mediational hypothesized model and conclude that cognitive age does mediate the relationships between demographic variables and the related variables of the adoption behavior of high-tech products.

**Testing the Hypothesized Structural Model**

The hypothesized model describes the relationships of cognitive age to consumers’ demographic characteristics and innovativeness well. Ten of the twelve hypothesized paths are significant (see Figure 1). Hypotheses for chronological age, gender, educational level, marital status, and income level are all supported by the data, confirming the findings reported in the literature, whereas the hypothesis for employment status is not supported. Because the unemployed consumers consist of students, housewives, and the retired in this study, it is possible that students and/or housewives may have equal or younger cognitive age than the employed consumers causing a non-significant outcome. Hypotheses about the consequence variables of cognitive age are all supported by the data. It seems that cognitive age is a key factor in explaining consumers’ behaviors under uncertainty in innovative-product adoption context. Furthermore, the hypothesized relationships among the related variables of the adoption behavior of high-tech products are all supported with only one exception of the relationship between technology anxiety and adoption behavior of high-tech products. In summary, the way that cognitive age exerts its influence on the adoption behavior of high-tech products has three paths: (1) the direct impact of cognitive age on the adoption behavior; (2) the indirect impact through information-seeking behavior; and (3) the indirect impact through information-seeking behavior via technology anxiety.

Technology anxiety influences adoption behavior only indirectly through its impact on information-seeking behavior. This mediation situation agrees with Taylor’s (1974) theory that consumers will not give up choice immediately when facing risk and anxiety. Instead, most of the time, they tend to reduce risk and anxiety by seeking information about that purchasing decision (Roselius 1971). Another possibility is that attitudes may not directly influence behavior; they influence behavior only through their impact on intentions (Bagozzi 1981; Fishbein and Ajzen 1975). The other case is that attitudes have a direct effect on behavior only when intentions are poorly formed (Bagozzi 1989). Because the measure of technology anxiety in this study is restricted to the macro effect subject to the items available developed by the E-ICP, the final possible case is that the risky nature of high-tech products exerts more impact over the macro effect on the adoption behavior of high-tech products, but this impact does not reflect in such a measure that the impact of technology anxiety is not significant.

**CONCLUSIONS AND IMPLICATIONS**

Results of this study suggest the mediational role of cognitive age between consumers’ demographic characteristics and their innovativeness. Cognitive age does lend itself to functioning as a mediator in the adoption context of high-tech products, and thus becomes a more capable predictor of the consuming behavior of innovative products. Cognitive age is a composite psychological variable with profound meanings; it signals not only the message of chronological age, but also the information of other consumer demographic characteristics. By focusing on cognitive age, marketers can survey consumers’ cognitive age instead of surveying all the demographic variables. Therefore, it is more efficient to focus on cognitive age as a key segmentation variable. Furthermore, cognitive age directly determines consumers’ adoption behaviors in the high-tech product context. For a high-tech product company, target customers are the cognitively younger dispersed throughout various age groups, not just the chronologically younger. In this
sense, cognitive age is a more effective segmentation variable than demographic variables. In summary, marketers can both efficiently and effectively segment their markets based on consumers’ cognitive ages.

To go a step further, marketers can create a younger cognitive age in consumers through enhanced communication marketing efforts. Cognitive age is a kind of self-concept that contains two parts: individualistic and social self-concepts. Intrinsic desires are at the core of the individualistic self-concept and are more fundamental and long lasting, while mimetic desires are important to the social self-concept and are inherently unstable (Bagozzi 1995). Intrinsic desires cannot be changed by short-lived external stimuli like ads, but mimetic desires may be. Marketers can thus influence consumers’ cognitive age by means of changing mimetic desires towards being young. In this way, cognitive age can be transformed into a controllable strategic variable, which can then broaden the potential market for high-tech products.

The findings of this study differ from Gwinner and Stephens (2001) in the mediational role of cognitive age in relation to educational and income levels and innovativeness. There exists a possible culture difference between cognitive age and the consuming behavior of education and income-related innovative products. Cognitive age may implicitly reflect some meanings of a particular culture or social norm. In the case of culture difference, multinational company marketers may simply segment the market based on consumers’ demographic characteristics in Western countries when their products are education or income-related; but, in Eastern countries, they need to target data about consumers’ cognitive age to achieve the same effective segmentations.

Finally, because high-tech products are usually more complex, sophisticated, expensive, and require more effort to work well, consumers need more knowledge about products to ensure they are worth buying. It would be worthwhile to offer product related information to consumers about the value of their products. Moreover, the macro effect of high-tech products may hinder consumers from buying products even if they are worth buying. Information should be provided as well to justify purchase of the product by showing the positive benefits of the product, such as healthy benefits, recyclable material used, no side effects, etc, or show a copy of inspection or patent certificates.

LIMITATIONS

Because the sample used in this study is the E-ICP database, the measure of constructs are selected from and restricted to the extant questionnaire items. Although the screening process is stringent and evaluations of the CFA model are satisfactory, it still has some measurement limitations. The content domain of technology anxiety and adoption behavior of high-tech products is not fully inclusive. Technology anxiety, in our view, comes from two sources: the risky nature and the macro effect of innovative products. But the measure of technology anxiety in this study seems to include only the macro effect section, and thus cannot cover the risky nature of high-tech products. Although it may reflect the present situation of technological lifestyle in Taiwan, it is worth mentioning for improvement purposes what measure of adoption behavior of high-tech products focus on Internet service. Except for the four-dimension measures of cognitive age, the measure of other constructs (TA, IS, and AP) in table 1 serves as a beginning. In searching for a full content domain of each construct, it is recommended that future researches about adoption behavior of innovative products should more fully develop a richer set of items of these constructs based on theories. Finally, the adoption behavior of high-tech products is only one type of consumer innovativeness. Future studies may expand the scope of consumer innovativeness to other aspects, such as adoption of fashion products, novelty seeking, and risk-taking behaviors.

REFERENCES

Fishbein, Martin and Ick Ajzen (1975), Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research, MA: Addison-Wesley.


