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Attitudes Towards Computers and Information Technology at Three Universities in Germany, Belgium, and the U.S.

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Abstract — *Students' interest in computers and information technology is both a prerequisite and a goal of successful qualification programs. The present study was conducted to search for intercultural differences or cross-cultural consistency of attitudes in this field, based on the Computer and Information Technology Attitude Inventory (CITAI; Weinsier & Leutner, 1988). This instrument was developed to overcome theoretical and methodological problems of usual Likert-type questionnaires by (a) hiding the object of measurement from the responding student and (b) by using a factorial or facet design for constructing 72 items (titles of university short courses with and without reference to computers or information technology). Data on 529 students were collected at three universities in Germany, Belgium, and the U.S. Multidimensional scalings indicated high similarity of the interitem correlation structures across the three samples based on both point-to-point correspondences and facet theoretic regional analysis of the spaces. This cross-cultural consistency underlines the construct validity of the questionnaire design. However, some intercultural differences were found — for instance, that European students have a strong*

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preference for noncomputer as opposed to computer courses, whereas U.S. students do not have any preference. The results are discussed with regard to the initial hypothesis that an object loses its feature of being a controversial theme with strong effects on attitudes if that object becomes more and more a component of the normal environment.

Computers and information technology in general are going to be used in almost all areas of life. Consequently, strong efforts in computer education are observable all over the world, ranging from primary schools to universities. Some authors (e.g., Papert, 1980) write about "computer literacy" as a new and very important cultural technique like reading and writing, and others (e.g., Haefner, 1982) think that everyone should be educated in such a manner as to receive a kind of "computer license."

It seems to be a minor problem to change school curricula in order to provide basic education in information technology so that children and young students will learn to use and to appropriately evaluate this new technology, which is basically a normal component of their everyday environment (see, e.g., Fauser, 1987). However, among adults who are confronted with this new technology for the first time above the age of 20, one often finds disinterest, negative attitudes, or, in some cases, computer anxiety (Raub, 1981) and computerphobia (Jay, 1981). According to Rosen and Maguire (1990) about 50% of school and college students as well as business people may be "computerphobic." Although only a small group of these people may show classic signs of intense anxiety disorders, "it is also important to acknowledge that an additional segment of the population is uncomfortable with computers and computer-related technology and chooses to avoid computers whenever possible. Although these people are not 'phobic' in the classic psychological sense, they are at risk of losing a major battle in the technological revolution" (Rosen & Maguire, 1990, p. 184). Computer-related anxieties have attracted a lot of research in recent years (see the meta-analysis by Rosen & Maguire, 1990, on 81 papers published until 1989 and about a dozen related articles alone in this journal between 1989 and 1991).

Usually a person's attitude towards computers and information technology is measured by using a Likert-type questionnaire consisting of statements about that specific object. The person is asked to read through each of these statements and to specify the amount of agreement on a rating scale. The answers are then aggregated to yield one number which represents the person's attitude. Often the statements are defined to belong to different scales, which represent different components or aspects of the overall attitude and which are generated by factor analysis or other methods of item analysis.

Quite a large number of instruments for measuring computer-related attitudes or anxieties have been developed according to this traditional approach — for example, the Attitudes Toward Computers Scale (ATC; Raub, 1981), the Zolton-23 items "General Statements" questionnaire (ZOL23; Zolton & Chapanis, 1982), the Computer Anxiety Index (CAIN; Maurer, 1983), the Cybernetics Attitude Scale (CCAS; Wagman, 1983), the Computer Anxiety Scale (CAS; Loyd & Gressard, 1984), the Attitudes Towards Computer Usage Scale (ATCUS; Popovich, Hyde, Zakrajsek, & Blumer, 1987), the Computer Attitude Scale (CATT; Dambrot, Watkins-Malek, Silling, Marshall, & Garver, 1985), another scale by Bannon, Marshall, and Fluegal (1985), the Computer Anxiety Rating Scale (CARS;

Heinssen, Glass, & Knight, 1987), or the Blomberg-Erickson-Lowerg Computer Attitude Task (BELCAT-36; Erickson, 1987). Comparative validity studies were published by, for example, Kernan and Howard (1990) and Zakrajsek, Waters, Popovich, Craft, and Hampton (1990).

This traditional approach to attitude measurement, however, implies some methodological problems which may affect the measurement's validity and the general process of theory construction in that specific field. The goal of the present article is therefore twofold: on the one hand, to validate the Computer and Information Technology Attitude Inventory (CITAI) (Weinsier & Leutner, 1988), which was developed to overcome these measurement problems, and on the other hand, to check whether there are differences in attitude structures towards computers and information technology between students drawn from two European universities (a German and a Belgian) and students from a U.S. university. Such differences can be expected because computers as well as other new technological developments became widespread in the USA before coming over to Europe, with a time lag of 5–10 years. It can be expected that, in their overall lifetime, U.S. students have had more contact with computers and information technology, thereby reducing the computer's significance as a controversial theme and an attitude object which strongly affects students' study interest. Omar (1992), for example, found that Kuwaiti students reported less positive attitudes towards computers than U.S. college students on almost every item of the instrument used. Allwood and Wang (1990) expected differences in conceptions of computers among students in China and Sweden because of intercultural differences in the use of modern technology, especially the far more extensive use of computers in Sweden. However, based on the assumption that a new technology will initially be seen in optimistic terms, the difference was expected in the opposite direction, with more favourable attitudes in China (see also Marcoulides, 1991, and Marcoulides & Wang, 1990, for a comparison of U.S. and Chinese student computer anxiety, and Collis & Williams, 1987, for a comparison of British Columbia and Chinese student computer attitudes).

THE CITAI — ITS DESIGN AND PREVIOUS STUDIES ON RELIABILITY AND CONSTRUCT VALIDITY

There are two basic ideas which led to the design of this instrument: First of all, the object of measurement (i.e., computers and information technology) should be hidden from the respondent in order to reduce the probability of response sets like social desirability with regard to the specific attitude object. Second, a factorial design for generating items should be used in order to gain control over factors which might be responsible for a high amount of error in measurement (see Leutner & Weinsier, 1991, for a detailed description).

The first idea, to hide the object of measurement, was realized by not asking directly about the student's attitude towards computers and information technology, but instead asking about interest in voluntarily taking so-called "short courses" which might be offered as extracurricular courses at the university. The object of measurement was hidden by using two different types of course descriptions: One type contained a term which was related to computers or information technology, the other did not. The second idea, to gain control over factors which might independently or in conjunction with computers affect a student's study interests, was realized by not writing a haphazard random sample of course descriptions, but by introducing three control factors to get parallel and balanced random samples of computer- and non-computer-related course descriptions. All in all, four item-design facets were used: (a) the academic discipline from which the course is taken (natural sciences, humanities, interdisciplinary) as the first control factor, (b) the content to which the course is related (general, text processing, data processing) as the second control factor, (c) the kind of involvement with regard to the specific course content (theoretical, practical) as the third control factor, and (d) the presence or absence of a term which relates the total course to computers or information technology (with, without) as the factor of measurement interest. These four facets can be crossed completely to generate (3×3×2×2) 36 different types of course descriptions. Two different specific course descriptions were formulated for each type. Eight filler items were added to this set of (2×36) 72 items to broaden the scope of course desriptions so that the total questionnaire now consisted of 80 items (see Table 1 for examples). Students were asked to rate their study interest on a 5-point Likert-type scale of so-called "smiley faces," ranging from *definitely no interest* to *very high interest* in taking that course, given that it would be offered at the university and that time would not be any problem. Accordingly, from the traditional three components or varieties of attitudes (cognitive, affective, conative-instrumental) the CITAI is designed to measure the conative–instrumental aspect of computer and information technology attitude.

In order to measure the instrument's reliability and to validate it, a study corresponding with the mapping sentence in Figure 1 was conducted with students from Aachen University in Germany and from Liége University in Belgium (see Leutner & Weinsier, 1991, for a detailed description). At each university 100 students were surveyed with a questionnaire in their own language (i.e., in German and French, respectively). The results of these two studies were encouraging, with regard to both the instrument's reliability and its construct validity in terms of empirical interrelations between different subsets of course descriptions.

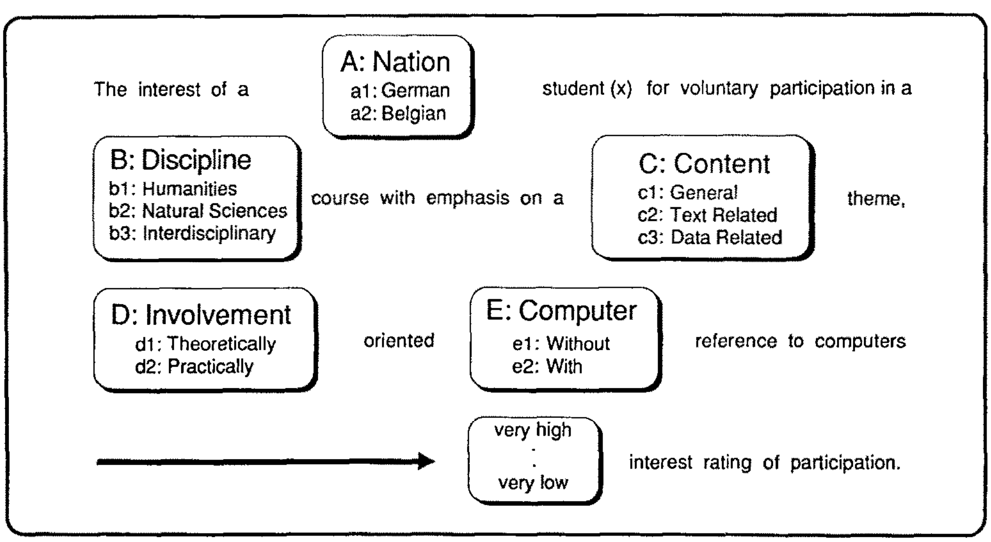

Figure 1. Mapping sentence of the Aachen–Liege study.

Table 1. Study Interest Items

Type Number	Facet Structure	Item Text (one of two items)
01	$b_1c_1d_1e_1$	The ethics of scientists as a topic of philosophical research
02	$b_1c_1d_1e_2$	Art and computer technology
03	$b_1c_1d_2e_1$	Practical exercises in the philosophy of leadership
04	$b_1c_1d_2e_2$	Practical exercises in the use of electronic data analysis in the humanities
05	$b_1c_2d_1e_1$	Comparisons of writing styles in literary artwork
06	$b_1c_2d_1e_2$	Possibilities and limitations of computerized literature research in the humanities
07	$b_1c_2d_2e_1$	Exercises in linguistic analysis of news and press reports
08	$b_1c_2d_2e_2$	Exercises in the use of literature data banks in the humanities
09	$b_1c_3d_1e_1$	Overview of strategies for data analysis in the humanities
10	$b_1c_3d_1e_2$	A look at the power struggle: Systems analysis research comes to the humanities
11	$b_1c_3d_2e_1$	Workshop for observational-approach techniques in the humanities
12	$b_1c_3d_2e_2$	Practical course in humanities-specific data representation through computer graphics
13	$b_2c_1d_1e_1$	Excerpts from the chemistry of man
14	$b_2c_1d_1e_2$	Historical perspective of electronic information systems in the natural sciences
15	$b_2c_1d_2e_1$	Science students and environmental protection: Getting involved
16	$b_2c_1d_2e_2$	Hands-on sciences course: Technology-based systems designing
17	$b_2c_2d_1e_1$	Strategies for writing scientific and technical texts and reports
18	$b_2c_2d_1e_2$	Overview for text-processing systems for use in the natural and technical sciences
19	$b_2c_2d_2e_1$	Writing technical papers in the natural or engineering sciences
20	$b_2c_2d_2e_2$	Workshop in using text-processing systems with special application to the natural sciences
21	$b_2c_3d_1e_1$	Basics of experimentation in the natural and technical sciences
22	$b_2c_3d_1e_2$	Basics of steering and control in robotics technology
23	$b_2c_3d_2e_1$	Practical course in empirical modelling of technical systems
24	$b_2c_3d_2e_2$	Special problems course in the use of microprocessors for technical systems control
25	$b_3c_1d_1e_1$	Seminar in interdisciplinary fundamentals in scientific research
26	$b_3c_1d_1e_2$	Information technology and its recent changes
27	$b_3c_1d_2e_1$	Workshop in speech writing and public speaking
28	$b_3c_1d_2e_2$	Practical course in computer-aided instruction (CAI)
29	$b_3c_2d_1e_1$	Interdisciplinary strategies in scientific literature work
30	$b_3c_2d_1e_2$	Strategies for computer-aided literature searches in the university library
31	$b_3c_2d_2e_1$	Practical course for preparing for written exams
32	$b_3c_2d_2e_2$	Practical exercises in the use of text-processing systems for studying and exam preparation
33	$b_3c_3d_1e_1$	Statistical analysis as an interdisciplinary tool
34	$b_3c_3d_1e_2$	Basic principles of computer-aided data analysis
35	$b_3c_3d_2e_1$	Interdisciplinary workshop in statistical problem solving
36	$b_3c_3d_2e_2$	Workshop in programming languages

First of all, the internal consistency of measuring a student's interest in taking computer-related courses is $\alpha = .91$, and the interest in taking one-to-one parallel non-computer-related courses can be measured with a reliability of $\alpha = .87$. Both values represent excellent reliabilities, which are quite rare in the field of attitude measurement. It should be mentioned that these subscale reliabilities are not the result of an iterative process of item analysis, starting with a large set of items and reducing it to a minimal set with maximum reliability. These reliabilities were simply computed for two subscales consisting of 36 items each as they were defined and generated within the facet-theoretic framework.

Second, as a step in validating the instrument, a strong correspondence could be established between the instrument's internal correlation structure and its definitional system. On the one hand, the correlations within subscales, defined according to the item-design facets, were non-negative, which was expected according to Guttman's so-called "First Law of Attitude" (Levy, 1981), since each subscale constitutes its own attitude object. On the other hand, multidimensional scalings indicated that the item-design facets "discipline," "course content," and "computer-relatedness" played distinctive axial roles in organizing the interitem correlations into components independent of each other, the involvement facet being of minor, yet observable, relevance. Even more, the correlation results could be underlined by differences in mean subscale values: In an analysis of variance, the within-person item-design factors discipline, course content, and computer-relatedness turned out to produce significant main effects, whereas the effect of the involvement factor was not significant.

These results indicate that the initial ideas of hiding the object of measurement, computers and information technology, within university course descriptions and introducing control factors to get parallel and balanced item samples were very successful in devising an instrument which is highly reliable and which seems to be quite valid with regard to its inner structure.

CROSS-CULTURAL SIMILARITY OF ATTITUDE STRUCTURES

One of the most interesting points not mentioned yet was the congruence of the results of the two independent student samples from two different universities, which differ in their technology versus humanities–medicine orientation and are located in two different European countries. The multidimensional structures were very similar, although not identical in terms of a perfect one-to-one correspondence of points, and an analysis of variance indicated no significant differences between the two samples with regard to mean subscale values. Therefore, from a more practical point of view, it was decided to take both samples as being drawn from one population of students. At the same time, from a more theoretical point of view, these results indicated a high amount of cross-cultural consistency in attitude structures. This raises the question of whether that structure, as it was identified with the CITAI, is valid for other countries, especially for a culture in which computers have been an integral part of society for many years (see Allwood & Wang, 1990, for a discussion of the culture concept). Accordingly, a further study was conducted with students of a U.S. university. It was expected that there would be some similarity between the European and American attitude structures but that the comparison Aachen–Liége would yield higher similarity than the comparisons Aachen–U.S. and Liége–U.S.

METHOD

Material

The CITAI was translated from German/French into English by the second author, who is a native English speaker and has a strong German background based on several studies and research projects conducted in Europe, especially in Germany (for a discussion of the translation problem see Leutner & Weinsier, 1991).

Subjects

Three hundred and twenty-nine subjects were drawn randomly from the campus of Clemson University, South Carolina, and surveyed in three waves. This U.S. sample was pooled with the two European university samples surveyed by Leutner and Weinsier (1991). All in all, about half of each of the three student samples (Aachen, Liége, Clemson) was male versus female, and about half consisted of students from the humanities versus natural and engineering sciences.

Data Analysis

Two independent aspects of the empirical structure of observations (see Guttman, 1981a) — that is, correlations between and the overall level of student interest ratings — were investigated and compared with regard to cross-cultural stability or intercultural differences. The eight filler items were discarded.

In order to investigate the questionnaire's internal correlation structure, the two replication ratings within each of the 36 item-design cells were added to get 36 values for each student. Then, product–moment correlation coefficients (r) were calculated as input for multidimensional scaling. This measure of linear correlation was used instead of a measure of monotone or weak-monotone correlation like μ_2 because r is calculated faster and is more commonly used, and because the difference between scalings of r and μ_2 matrices is usually so small that it can be disregarded (Leutner, 1990). The multidimensional scalings were performed using KYST-2A (Kruskal, Young, & Seery, 1978) with its nonmetric option. The final step in analysing the correlations was to compare the American structure with those derived from the two European samples using the same scaling procedures.

In order to analyse intercultural differences with regard to the mean level of attitude towards computers and information technology, the reliabilities of the computer and the noncomputer subscales were obtained for the U.S. data and compared to the European data. After that, the differences between computer and noncomputer subscale scores were calculated and compared over the three samples.

RESULTS

Comparing the Instrument's Internal Correlation Structures

It was not expected that the three correlation matrices, which are given in the appendices, would be identical. Such a null hypothesis seems to be invalid, since there should be at least some minor differences which cannot be prevented during the process of translating the questionnaire into three different languages. Indeed, Box's M-test indicated that the three variance–covariance matrices are significantly not homogeneous, $M = 2531.0$, $F(1332, 208331) = 1.64$, $p < 0.001$. Also, the correlation matrices are not homogeneous, which was tested by using z-standardized variables to approximate Box's test so that variances are 1.00 and covariances are correlations.

A less rigorous conceptualization of homogeneity was then tested by using multidimensional scaling techniques. The basic idea is to remove some amount of measurement error from the correlation matrices by means of a monotone (not linear) approximation of the 36-dimensional correlations by distances of a low-dimensional Euclidian space and then comparing the distances instead of the correlations. The three correlation matrices were separately scaled in four-dimensional Euclidian space according to the four item-design facets, yielding excellent fit. The stress values are 0.064, 0.079, and 0.070 for the Aachen, the Liége, and the Clemson data, respectively.

The first hypothesis to be tested was that the pairwise point-to-point similarity of the three scaling solutions is purely random, a kind of "nullest" of all null hypotheses (Cliff, 1973). This test was performed by computing the congruence coefficient for all three pairs of distance matrices. Note that for quantifying the similarity of multidimensional configurations the congruence coefficient c should be used, which — unlike the well-known product moment coefficient r — does not center values around the mean before calculating the scalar product (see Borg & Leutner, 1985). According to Monte-Carlo studies (see Leutner & Borg, 1985), all three values (Table 2) are far below those which would have been expected for random configurations, indicating that there is a certain amount of point-to-point similarity among the three configurations. Interestingly, the similarity between the Belgian and U.S. configurations is minimally higher compared to the similarity among the two European configurations. This difference, however, is so small that it is considered irrelevant.

Given these results, the nullest of all null hypotheses can be discarded. The next step was to check whether there is cross-cultural consistency with regard to the roles the questionnaire's item-design facets are playing in organizing the multidimensional space. The basic idea is to partition the whole space according to the elements of each facet of a prespecified facet design: Because each facet breaks down the whole set of variables into nonoverlapping subsets, the corresponding subsets of points should make up nonoverlapping regions within the multidimensional space (see Levy, 1981; Lingoes, 1979, 1981, for detailed descriptions). This facet-analytic methodology is especially useful within the context of scientific replications (see Guttman, 1981a), and examples can be found in many fields of psychological research (e.g., Guttman & Levy, 1991; Snow, 1980: structure of intelligence tests; Borg & Bergermaier, 1981: quality of life studies; and many others like Borg, 1981; Canter, 1985; Leutner, 1985; Shye, 1978).

One problem with analysing the outputs of multidimensional scaling programs is that these programs rotate the configuration of points to some technically defined criterion. This is no problem in analysing two-dimensional configurations. But if there are more than two dimensions (say three), then the rotational position of the coordinate axes might unfortunately be just such that no partitions with regard to the facet design might be possible in the plots of dimensions 1/2, 1/3, and 2/3. In this case, researchers often build up a three-dimensional geometric model by repre-

Table 2. Similarity of Multidimensional Scaling Configurations

	Aachen	Liege	Clemson
Aachen	—	0.254	0.285
Liege	0.967	—	0.231
Clemson	0.959	0.973	—

Note. According to Borg and Leutner (1985) and Leutner and Borg (1985). Lower-half matrix: Coefficient of congruence c. Upperhalf matrix: Coefficient of alienation c' (5%-crit. value $c' = 0.393$).

senting points as small balls and then rotating the configuration by hand to identify any correspondence with theoretical expectations. It is obvious that this would not be easy with scaling solutions in higher dimensional spaces. A tool which enables one to interactively perform exactly these rotations with multidimensional configurations is a personal computer program called FACET (Leutner & Lieser, 1990). A second feature of FACET is that each point can be represented by its label on each of the facets of the facet design, so that it is easy to identify clusters, regions, or manifolds with regard to any specific facet, given that such structures exist within the space.

This program was used to analyse and to compare the three four-dimensional scaling solutions of the Aachen, the Liége, and the Clemson correlation matrices. As mentioned above, there was some significant point-to-point similarity. The question to be addressed then was to identify the roles of the item-design facets. In the former study (Leutner & Weinsier, 1991), the discipline, content, and computer facets were identified to play distinct axial roles. The involvement facet did not play a very distinct role, but was nevertheless axial in structure. Additionally, it should be mentioned that the elements of the content facet (i.e., "general," "text-processing," and "data-processing") could not be separated perfectly with regard to all three elements, but a separation of text- and data-processing was possible.

A first look at the plot of dimensions 1/2 of the three unrotated scaling solutions indicated quite obviously that the discipline facet defines the first dimension and the computer facet the second dimension. Using FACET, these two dimensions were then orthogonally rotated through dimensions 3 and 4, coming up with a projection of all 36 points which can be partitioned nearly perfectly with regard to the discipline and computer facets (Figures 2 and 3). Given this rotational position of plot 1/2 with regard to dimensions 3 and 4, the rotational position of plot 3/4 is fixed with regard to plot 1/2. For each of the three scalings, this "window" to the configuration of all 36 points is given in Figures 4 and 5.

There are apparent similarities between all three configurations with regard to the roles the item-design facets play in organizing the multidimensional spaces, as can be seen from the figures: The discipline and the computer facet are axial in plot 1/2 (Figures 2 and 3), and the content facet is axial in plot 3/4 (Figure 4), with a tendency to be polar. The involvement facet tends to be modular in plot 3/4 (Figure 5). In plots 1/2 (Figures 2 and 3) there are only a few points misclassified, which are indicated by small cycles: no misclassification in the German and Belgian plots and two misclassifications in the U.S. plot. Furthermore, the German and the Belgian plots 1/2 are highly similar with regard to the discipline facet, the humanities and the natural/engineering sciences being clearly separated. U.S. plot 1/2, however, indicates that humanities and natural/engineering sciences are not as different for these students as for the European students: There are a lot of courses within both subsets of course descriptions which tend to be related to each other.

The plots of dimensions 3/4 can be perfectly partitioned according to the text- and data-processing elements of the course content facet, which was already mentioned in the former study (Figure 4). In the present analysis, however, it can be shown that the "general" element of this facet can also more or less be identified in plots 3/4 (Figure 4): quite well in the German plot, medium in the Belgian, and worse in the U.S. This again seems to indicate that U.S. students do not differentiate with respect to the specific content of courses as strongly as European students.

The plots of dimensions 3/4 also give some fuzzy modular role to the involvement facet (Figure 5): It seems to be that theoretical courses are more central,

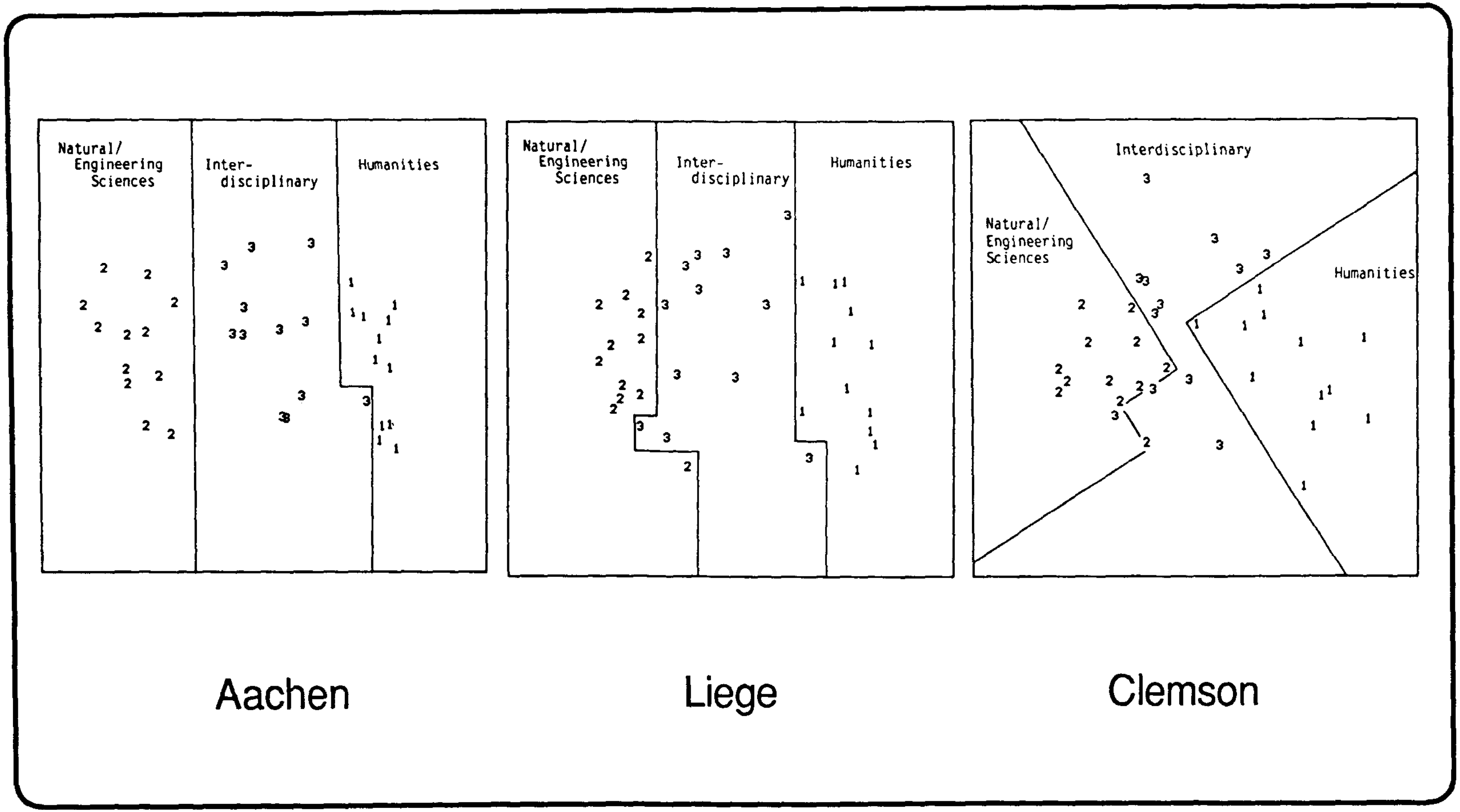

Figure 2. Multidimensional scaling plot 1/2, partitioned according to the discipline facet.

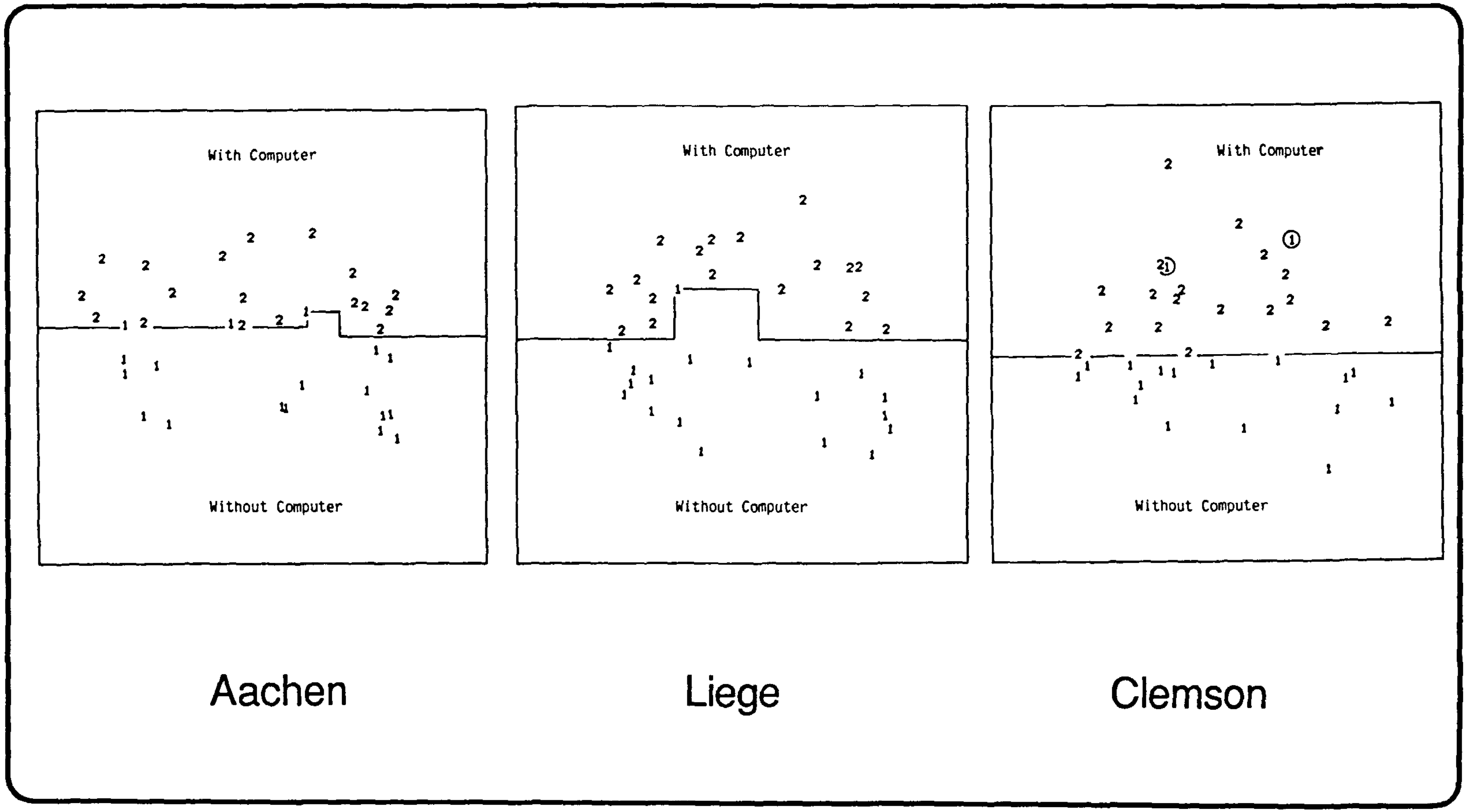

Figure 3. Multidimensional scaling plot 1/2, partitioned according to the computer facet.

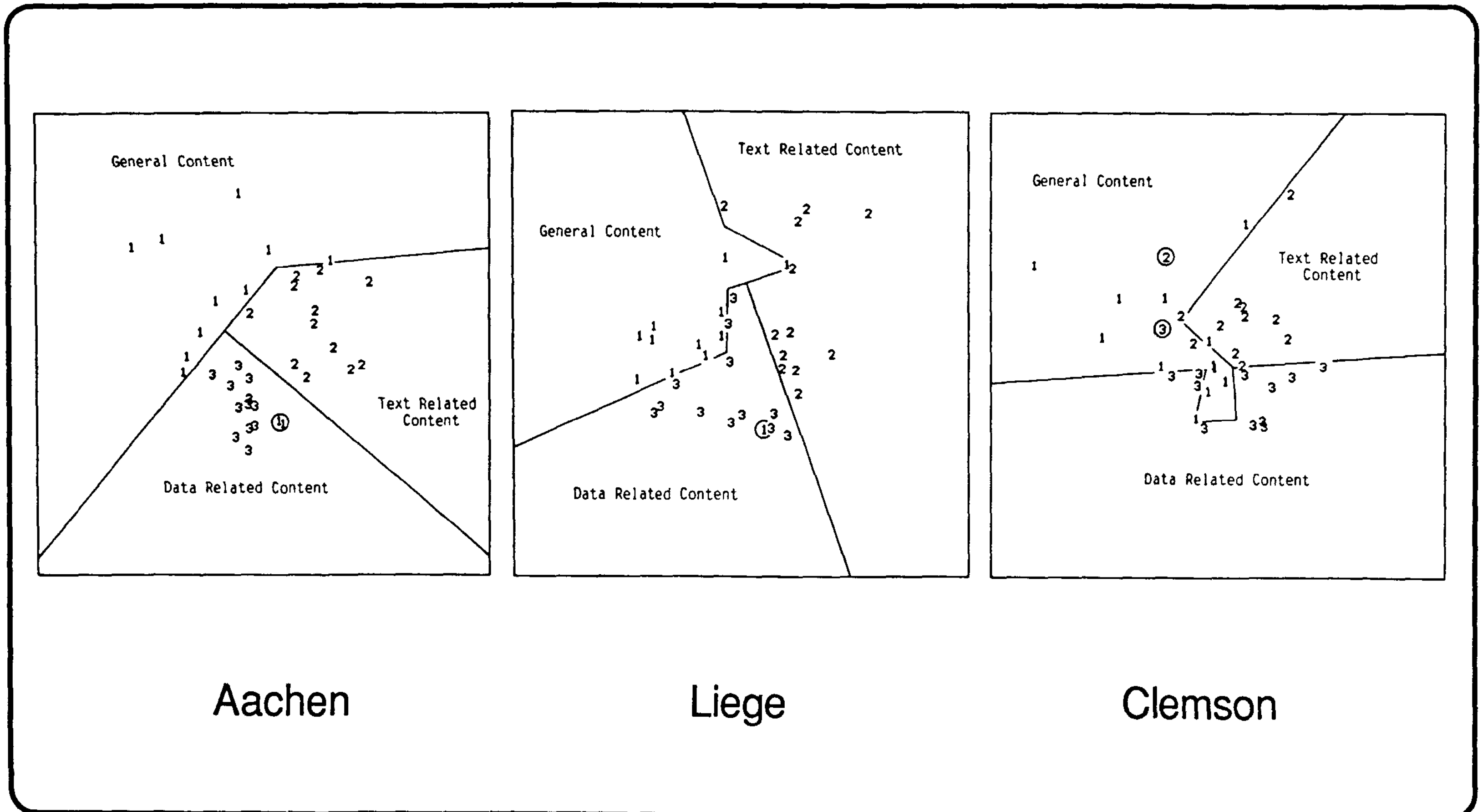

Figure 4. Multidimensional scaling plot 3/4, partitioned according to the content facet.

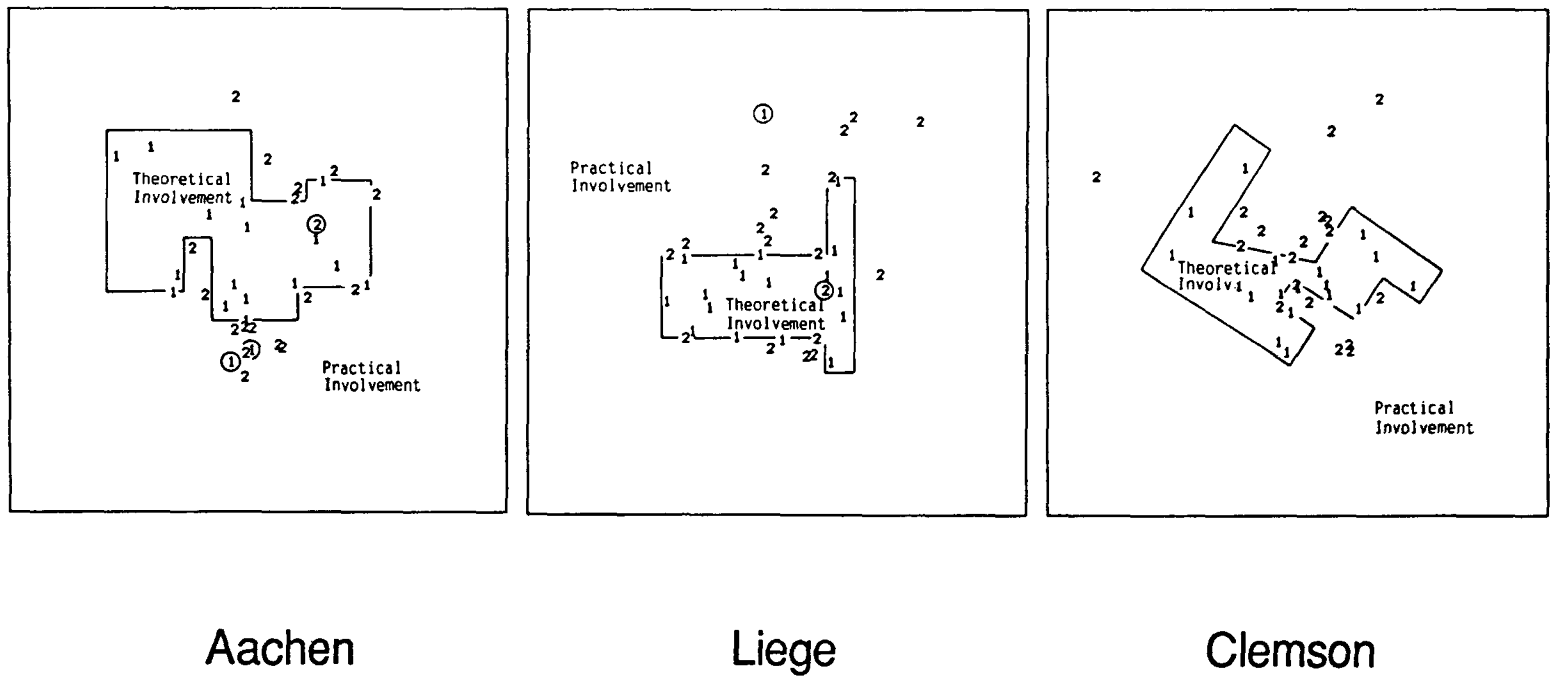

Figure 5. Multidimensional scaling plot 3/4, partitioned according to the involvement facet.

whereas practical courses are more decentral. But this is only a very slight trend which underlines that the involvement facet does not play a very distinct role in organizing students' attitudes towards courses.

Summarizing these results on comparing the instrument's inner correlational structure, it can be stated that, first of all, there is a high amount of point-to-point similarity between all three structures, as was quantified by the congruence coefficient. Second, the item-design facets are playing distinct roles in each of the three scalings, which are identical with only some minor discrepancies. These discrepancies are that the U.S. students seem to discriminate less between disciplines and course contents.

Comparing the Mean Levels of Attitude Towards Computers and Information Technology

As a first step, reliabilities for the computer and the noncomputer subscales of the questionnaire were computed separately for each student sample. As Table 3 indicates, the values are all excellent, being higher for the U.S. as compared to the European data. Second, for each student the difference between his or her value on the computer scale minus the value on the noncomputer scale was calculated. Note that this difference is based on parallel subsets of questionnaire items — that is, it reflects the amount of preference a student has for computer as opposed to noncomputer courses, adjusted for all other differences between courses which were controlled by completely crossing the three course-defining control factors. Therefore, these individual preference values should not be affected by the discipline from which the courses were taken, nor by the course content, nor by the kind of involvement with regard to that content. Furthermore, the preference values should not be affected by potential interactions of these factors with the presence or absence of computer-related terms in course descriptions nor by any other interaction which can be formulated within the item-design.

Table 3. Reliabilities in Terms of Internal Consistency (Cronbach alpha)

	N of Items	Total	Aachen	Liege	Clemson
N of Students		529	100	100	329
Computer Facet					
Computer Scale	36	.942	.896	.918	.956
Noncomputer Scale	36	.923	.889	.853	.941
Discipline Facet					
Natural/Engineering Sciences Scale	24	.938	.921	.908	.952
Humanities Scale	24	.924	.915	.892	.936
Interdisciplinary Scale	24	.906	.880	.868	.924
Content Facet					
General Scale	24	.884	.776	.800	.918
Text-Processing Scale	24	.902	.869	.842	.925
Data-Processing Scale	24	.920	.893	.886	.935
Involvement Facet					
Theoretical Scale	36	.932	.882	.885	.951
Practical Scale	36	.918	.868	.849	.940

The means and standard deviations of these preference values are given in Table 4, indicating strong preferences for non-computer-related courses in both European samples and no preference at all for the U.S. sample. Setting the probability of an alpha error at any convenient level, the overall differences between the means are significant: $F(2, 526) = 11.03$, $p < 0.001$, $R^2 = 0.04$. As can be expected, the linear contrast between the two European samples is not significant ($F < 1$), whereas the linear contrast between the combined European samples and the U.S. sample is significant: $F(1, 526) = 21.732$, $p < 0.001$. Note that Bartlett's test indicated nonhomogeneous variances: $\chi^2(2) = 27.130$, $p < 0.001$. Therefore, the F test of significance will be slightly affected for the present data, especially because the cell frequencies are unequal. Given these high F values, however, the mean differences found can be regarded as being valid. Furthermore, several analyses of variance computed by splitting the U.S. sample into different subsamples indicated the stability of the effects found: There were no mean differences between U.S. subsamples, but there were always differences between the European and the U.S. means.

As expected at the outset, the preference for computer courses as opposed to noncomputer courses is strongly related to students' amount of computer contact. This variable was measured by one additional questionnaire item on computer usage, which asks the student to rate on a 5-point scale (*never, seldom, sometimes, often, very often*) how often a computer had been used. The product–moment correlation between the amount of computer usage and the computer preference value is $r = 0.35$. Furthermore, across the three student samples the computer usage means follow the same trend as the computer preference means (Table 4). These differences in computer usage are significant, $F(2, 526) = 67.27$, $p < 0.001$, $R^2 = 0.20$, as is the linear contrast between the two European and the Clemson samples: $F(1, 526) = 127.14$, $p < 0.001$. Note that the analysis of variance is only slightly affected by nonhomogeneous variances: $\chi^2(2) = 5.59$, $p = 0.061$.

In order to analyse whether the sample differences in computer preferences are possibly affected by sample distribution differences with regard to student's major and student's gender, computer preferences were broken down by these demographic variables. For smoothing cell frequencies, a subsample of 226 students was used in this analysis consisting of students who could clearly be classified as belonging to either mathematics/natural/engineering sciences, on the one hand, or philosophy/literature/linguistics/social sciences, on the other hand. The results (Table 5) indicate that, with only a few exceptions, the trend for European students having strong negative and U.S. students having higher computer preference values is independent of student's major and student's gender. Note that this result is given only descriptively, since significance tests of these interaction effects would be severely affected by

Table 4. Means and Standard Deviations of Computer Preference Values and of Computer Usage

		Total	Aachen	Liege	Clemson
Computer Preference	Mean	−2.03	−4.80	−4.06	−0.58
	(*SD*)	(9.39)	(9.97)	(11.79)	(9.39)
	N	529	100	100	329
Computer Usage	Mean	2.97	2.46	2.01	3.42
	(*SD*)	(1.31)	(1.30)	(1.25)	(1.10)
	N	529	100	100	329

Table 5. Computer Preference Values, Broken Down by Students' Major and Students' Gender

			Total	Aachen	Liege	Clemson
		Mean	−0.34	−4.20	+2.46	+2.19
	Male	(*SD*)	(9.75)	(9.67)	(10.17)	(7.92)
Mathematics/		*N*	86	35	24	27
Natural Sciences/						
Engineering Sciences	≈	Mean	−1.64	−5.80	−0.14	+1.18
(Major 1)	Female	(*SD*)	(12.21)	(11.40)	(18.12)	(7.80)
		N	28	10	7	11
		Mean	−2.31	−4.18	−3.47	+0.75
Philosophy/	Male	(*SD*)	(9.71)	(9.56)	(9.10)	(10.26)
Literature/		*N*	48	17	15	16
Linguistics/						
Social Sciences		Mean	−7.41	−7.53	−9.00	−5.33
(Major 2)	Female	(*SD*)	(8.24)	(9.04)	(10.89)	(4.39)
		N	64	32	17	15
		Mean	−0.69	−4.56	+1.87	+1.74
	Major 1	(*SD*)	(10.32)	(9.97)	(12.09)	(7.75)
		N	114	45	31	38
Total						
		Mean	−5.22	−6.37	−6.41	−2.19
	Major 2	(*SD*)	(9.21)	(8.65)	(10.32)	(8.44)
		N	112	49	32	31
		Mean	−1.05	−4.19	+0.18	+1.65
	Male	(*SD*)	(9.74)	(9.54)	(10.08)	(8.77)
		N	134	52	39	43
Total						
		Mean	−5.65	−7.12	−6.42	−2.58
	Female	(*SD*)	(9.92)	(8.83)	(13.60)	(6.77)
		N	92	42	24	26

Note. In order to smooth cell frequencies, this table reports data based on 226 classified students only. Clemson students are drawn from the second of three surveyed samples.

unequal and, in part, low cell frequencies and inhomogeneous variances. Two further trends, however, can be taken from Table 5, which were expected (see the meta-analytic results of Rosen & Maguire, 1990): Male students have higher computer preferences than females (R^2 = 0.05), which seems to be independent of student's major and student's nationality, and students from major 1 (mathematics etc.) have higher preferences than students from major 2 (philosophy etc.) (R^2 = 0.05), which seems to be an independent effect as well (see, e.g., Lieskovsky, 1988, for the same effect comparing technical and philosophy students).

SUMMARY AND DISCUSSION

The present study was performed in order to search for intercultural differences with regard to students' attitudes towards computers and information technology. A second goal was to further evaluate the CITAI with respect to its reliability and cross-cultural validity (see Marcoulides, 1991, as an example for a comparative approach in assessing the invariance of the computer anxiety construct across U.S. and Chinese students).

While evaluating the instrument, we found that the surprisingly high similarity in correlation structures between independent student samples drawn from Aachen University, Germany, and from Liége University, Belgium, could be replicated with a student sample from Clemson University. According to the roles the item-design facets play in organizing the correlation structure, only minor differences were identified. Also, the high subscale reliabilities found in the European study could be replicated. Therefore, it can be concluded that the German, the French, and the English CITAI versions work very similarly, if not identically, in measuring students' study interests, which underlines the construct validity of this instrument.

At this point it should be noted that the CITAI was not designed for measuring different aspects of computer-related attitudes in a direct manner (aspects like anxiety and cognitive, affective, or behavioral orientations; see Kernan & Howard, 1990). The goal was to develop an instrument with which conative–instrumental attitudes towards computers and information technology could be measured indirectly by operationally defining this attitude as computer-related study interest and embedding it within a framework of other more or less related study interests (for a further discussion of this point see Leutner & Weinsier, 1991). The results of the present study reveal that the CITAI does this job quite well.

With regard to differences in mean levels of attitude towards computers and information technology, it was found that European students have a strong preference for noncomputer as opposed to computer courses, whereas U.S. students have no preference for one type of course over the other. This result can be interpreted in accordance with the hypothesis that an object loses its feature of being a controversial theme with strong effects on attitudes if that object becomes more and more a component of the normal environment. This interpretation has certainly not been proved by this study, but the strong correlation between computer preference and previous computer usage as well as the same trend for the means of both variables over the three samples underlines this interpretation. Furthermore, it should be noted that the trend observed in this study accounted for 5% of the total variance. This is definitely not a large effect, but it is an effect size which corresponds with that found in many other previous studies (see again the meta-analysis of Rosen & Maguire, 1990).

Going by these results, it is to be expected in the near future that the present trend among European students of avoiding confrontation with computers and information technology will nearly vanish when in Europe, as in the U.S. today, students will automatically have contact with computers, starting in primary school and continuing to university as well as outside educational institutions. Hopefully, European students will then have those resources available at their universities which are already standard for students at Clemson University: Each student receives an identity card together with an explicit access to the facilities of the university's computer center, especially to electronic mail. Furthermore, students have access to hundreds of personal computers and mainframe terminals available all over the campus. Last but not least, students can perform literature searches by having direct and interactive access to computer terminals in the library for working on ERIC and many other national databases as well as for searching through periodicals or the library's own volumes. As opposed to Aachen and Liége, it seems that students at Clemson have less aversion or disinterest in computers and information technology. On the contrary, they almost seem to use this technology as a normal tool in their studies.

Questions might be raised concerning the representativeness of this intercultural study. Obviously, it cannot be claimed that the student samples from the three universities are representative of their country or nation. Therefore, the results of this study can only, if ever, be generalized to these specific universities. But it can be stated that, on the one hand, Clemson University is an average-sized U.S. university with a balance of teaching and research, and it is expected that there are even more computing resources at larger U.S. universities and at U.S. universities with a stronger interest in research and development. On the other hand, to take one of the European samples for which the relevant information is definitely known by the authors, Aachen University is a large technical university in Germany with a strong interest in research and development. It can be assumed that there are fewer computing resources available at many other German universities. On a scale of technological development, Aachen seems to hold one of the top positions among German universities, whereas Clemson seems to hold a middle position among U.S. universities. Consequently, if computer preference is correlated with students' overall amount of technology contact at their university, the situation at many other German universities should even be worse than at Aachen University, whereas at many other U.S. universities the situation should be even better than at Clemson University. The investigation of this hypotheses, however, should be the topic of further research.

As a last point of discussion it should be mentioned that a specific methodological question is often raised when correlation structures are analyzed with regard to prespecified expectations. The questions are: Why use multidimensional scaling only? What about factor analysis or confirmatory factor analysis (see, e.g., the study of Bandalos & Benson, 1990, who tested the invariance of CAS factor structures for male/female and graduate/undergraduate students)? Instead of answering this question over and over again, we refer the interested reader to a discussion about this topic in the context of CITAI-evaluation studies published elsewhere (Leutner & Weinsier, 1991) or to more general and basic literature like Wilson (1928), Schönemann (1981), or Guttman (1981a, 1981b).

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APPENDIX A: CORRELATION MATRIX OF THE AACHEN SAMPLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	**	28	55	26	58	41	59	47	52	40	43	27	17	-13	13	-21	0	-5	12	2	-2	-23	-17	-24	57	19	32	-3	52	34	42	8	35	3	3	-4
2	28	**	37	15	16	15	14	12	21	39	20	26	-9	7	8	-1	-9	12	-5	0	-4	-8	-2	-9	26	39	23	-1	18	18	16	11	9	18	3	14
3	55	37	**	6	50	19	46	19	21	10	29	2	-16	-21	6	-29	-17	0	4	2	-20	-29	-32	-34	34	15	29	-29	31	5	27	-9	9	-20	-23	-13
4	26	15	6	**	28	49	31	61	66	64	71	68	-3	-6	-19	-23	-12	8	-20	-13	-9	-16	-8	-28	19	-1	27	41	51	41	21	52	33	41	32	41
5	58	16	50	28	**	44	65	43	36	37	39	23	-3	-16	5	-19	0	9	15	4	-12	-26	-18	-28	42	0	38	-2	48	33	51	15	22	-7	-6	0
6	41	15	19	49	44	**	46	67	49	58	40	46	0	-2	8	-24	-1	13	-5	5	-12	-17	-9	-20	32	5	35	31	54	42	35	47	29	22	26	22
7	59	14	46	31	65	46	**	43	42	33	41	29	2	-23	3	-25	-14	-4	8	-8	-21	-33	-20	-28	31	0	34	-3	57	26	49	13	36	-5	3	2
8	47	12	19	61	43	67	43	**	60	58	59	57	13	-2	9	-16	2	19	-3	11	-4	-14	-1	-19	35	16	41	35	57	52	37	44	34	30	35	27
9	52	21	21	66	36	49	42	60	**	66	80	63	7	-3	-6	-23	-6	10	0	-10	0	-12	-6	-24	38	13	28	29	63	36	27	33	68	40	34	22
10	40	39	10	64	37	58	33	58	66	**	60	62	15	14	-1	-3	3	27	-5	7	5	3	7	-1	40	15	22	37	57	40	18	37	39	46	44	39
11	43	20	29	71	39	40	41	59	80	60	**	72	7	-4	1	-15	-4	17	-3	-5	12	-6	3	-22	36	7	37	35	57	37	34	35	48	41	42	36
12	27	26	2	68	23	46	29	57	63	62	72	**	8	17	1	1	0	23	-7	4	9	2	10	-4	22	8	21	44	48	44	17	42	44	47	50	44
13	17	-9	-16	-3	-3	0	2	13	7	15	7	8	**	30	36	47	40	39	38	36	46	24	40	40	40	31	2	29	16	17	2	-2	29	25	42	18
14	-13	7	-21	-6	-16	-2	-23	-2	-3	14	-4	17	30	**	28	58	41	57	20	43	47	65	53	56	23	31	13	40	-6	20	-12	3	23	47	36	46
15	13	8	6	-19	5	8	3	9	-6	-1	1	1	36	28	**	52	48	52	53	56	46	28	39	35	34	27	28	26	11	18	36	10	18	21	28	20
16	-21	-1	-29	-23	-19	-24	-25	-16	-23	-3	-15	1	47	58	52	**	43	57	42	46	57	57	56	72	23	25	0	39	-20	5	-5	-3	3	20	27	30
17	0	-9	-17	-12	0	-1	-14	2	-6	3	-4	0	40	41	48	43	**	52	67	60	57	50	51	42	22	19	21	34	8	35	24	10	17	26	32	17
18	-5	12	0	8	9	13	-4	19	10	27	17	23	39	57	52	57	52	**	51	66	47	53	48	43	35	36	32	39	17	40	15	26	22	49	37	39
19	12	-5	4	-20	15	-5	8	-3	0	-5	-3	-7	38	20	53	42	67	51	**	53	46	31	34	34	28	21	19	13	10	23	30	-1	17	15	15	3
20	2	0	2	-13	4	5	-8	11	-10	7	-5	4	36	43	56	46	60	66	53	**	48	47	51	43	33	31	24	26	12	45	21	16	24	21	22	24
21	-2	-4	-20	-9	-12	-12	-21	-4	0	5	12	9	46	47	66	57	57	47	46	48	**	46	67	49	37	18	16	38	2	18	14	8	35	41	47	33
22	-23	-8	-29	-16	-26	-17	-33	-14	-12	3	-6	2	24	65	28	57	50	53	31	47	46	**	54	68	2	11	2	45	-10	19	-14	0	8	38	34	29
23	-17	-2	-32	-8	-18	-9	-20	-1	-6	7	3	10	40	53	39	56	51	48	34	51	67	54	**	58	21	16	12	46	4	20	14	18	40	49	53	35
24	-24	-9	-34	-28	-28	-20	-28	-19	-24	-1	-22	-4	40	56	35	72	42	43	34	43	49	68	58	**	8	11	-8	39	-20	0	-13	-4	6	25	41	26
25	57	26	34	19	42	32	31	35	38	40	36	22	40	23	34	23	22	35	28	33	37	2	21	8	**	39	50	17	48	26	37	10	45	24	24	24
26	19	39	15	-1	0	5	0	16	13	15	7	8	31	31	27	25	19	36	21	31	18	11	16	11	39	**	18	15	13	16	1	-1	17	18	6	22
27	32	23	29	27	38	35	34	41	28	22	37	21	2	13	28	0	21	32	19	24	16	2	12	-8	50	18	**	21	46	36	61	48	32	34	28	35
28	-3	-1	-29	41	-2	31	-3	35	29	37	35	44	29	40	26	39	34	39	13	26	38	45	46	39	17	15	21	**	15	40	21	53	24	53	57	62
29	52	18	31	51	48	54	57	57	63	57	57	48	16	-6	11	-20	8	17	10	12	2	-10	4	-20	48	13	46	15	**	43	47	30	50	35	30	15
30	34	18	5	41	33	42	26	52	36	40	37	44	17	20	18	5	35	40	23	45	18	19	20	0	26	16	36	40	43	**	41	52	35	40	29	31
31	42	16	27	21	51	35	49	37	27	18	34	17	2	-12	36	-5	24	15	30	21	14	-14	14	-13	37	1	61	21	47	41	**	40	37	18	20	20
32	8	11	-9	52	15	47	13	44	33	37	35	42	-2	3	10	-3	10	26	-1	16	8	0	18	-4	10	-1	48	53	30	52	40	**	14	38	32	48
33	35	9	9	33	22	29	36	34	68	39	68	44	29	23	18	3	17	22	17	24	35	8	40	6	45	17	32	24	50	35	37	14	**	59	57	37
34	3	18	-20	41	-7	22	-5	30	40	46	41	47	25	47	21	20	26	49	15	21	41	38	49	25	24	18	34	53	35	40	18	38	59	**	74	60
35	3	3	-23	32	-6	26	3	35	34	44	42	50	42	36	28	27	32	37	15	22	47	34	53	41	24	6	28	57	30	29	20	32	57	74	**	55
36	-4	14	-13	41	0	22	2	27	22	39	36	44	18	46	20	30	17	39	3	24	33	29	35	26	24	22	35	62	15	31	20	48	37	60	55	**

APPENDIX B: CORRELATION MATRIX OF THE LIEGE SAMPLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	**	38	56	20	31	21	25	49	28	13	36	27	-17	-11	27	-2	-7	4	13	15	6	-14	-5	-19	36	6	12	4	33	12	2	24	3	-7	9	-4
2	38	**	34	52	25	41	23	48	40	57	31	50	13	13	32	21	-3	16	3	25	13	10	2	27	31	40	12	30	27	33	0	22	23	26	24	20
3	56	34	**	10	55	31	43	33	18	7	33	18	-18	-13	22	-23	-8	1	1	4	-16	-33	-37	-29	9	6	-1	14	57	6	18	34	-2	-4	12	10
4	20	52	10	**	-3	44	13	60	46	72	42	70	-4	23	2	-1	5	16	10	22	8	10	12	15	6	20	2	42	15	39	-4	21	3	30	20	33
5	31	25	55	-3	**	28	52	29	18	0	21	14	-10	-13	7	-26	-17	-8	-3	-11	-20	-29	-35	-24	-6	-7	-8	-4	47	-7	17	22	7	-13	-3	5
6	21	41	31	44	28	**	32	66	25	48	34	48	-2	24	-5	-16	14	23	19	13	-1	-4	-4	0	10	31	-5	38	21	42	22	34	18	35	31	26
7	25	23	43	13	52	32	**	39	22	6	20	16	-10	3	4	-16	-12	0	11	-2	-26	-22	-31	-21	3	2	27	18	39	13	46	34	0	-2	3	19
8	49	48	33	60	29	66	39	**	54	55	56	56	-9	6	2	-14	-1	10	12	13	-2	-10	-14	-12	9	16	5	32	28	42	20	24	16	22	18	17
9	28	40	18	46	18	25	22	54	**	50	55	48	16	4	25	6	16	24	26	19	16	-7	18	6	27	13	19	11	36	24	14	8	28	27	18	18
10	13	57	7	72	0	48	6	55	50	**	48	61	9	29	12	4	15	33	14	27	19	21	20	32	18	38	0	49	24	51	3	31	21	49	29	40
11	36	31	33	42	21	34	20	56	55	48	**	49	3	-15	7	-17	2	4	3	-3	11	-11	-8	-14	17	-3	-1	21	34	6	2	10	16	12	11	4
12	27	50	18	70	14	48	16	56	48	61	49	**	-12	18	11	-1	6	21	7	19	3	1	8	5	12	23	0	37	26	30	11	30	10	28	24	20
13	-17	13	-18	-4	-10	-2	-10	-9	16	9	3	-12	**	30	41	54	39	31	30	25	52	52	47	52	48	41	30	4	-3	15	-11	-10	50	35	36	30
14	-11	13	-13	23	-13	24	3	6	4	29	-15	18	30	**	17	44	33	52	38	50	43	55	45	50	28	62	25	41	2	44	16	26	36	71	59	68
15	27	32	22	2	7	-5	4	2	25	12	7	11	41	17	**	48	30	35	20	24	43	30	31	33	58	35	40	-3	31	5	5	10	37	10	19	11
16	-2	21	-23	-1	-26	-16	-16	-14	6	4	-17	-1	54	44	48	**	23	42	22	51	53	59	50	62	45	53	34	20	-8	21	0	0	41	39	38	21
17	-7	-3	-8	5	-17	14	-12	-1	16	15	2	6	39	33	30	23	**	49	64	38	51	38	58	28	46	21	38	0	14	25	19	12	31	30	43	25
18	4	16	1	16	-8	23	0	10	24	33	4	21	31	52	35	42	49	**	62	70	49	38	48	45	38	39	42	13	21	41	20	34	36	54	52	39
19	13	3	1	10	-3	19	11	12	26	14	3	7	30	38	20	22	64	62	**	51	38	24	45	31	37	10	49	-4	18	33	30	21	35	31	45	31
20	15	25	4	22	-11	13	-2	13	19	27	-3	19	25	50	24	51	38	70	51	**	39	45	44	44	40	43	38	35	15	53	18	36	34	54	56	43
21	6	13	-16	8	-20	-1	-26	-2	16	19	11	3	52	43	43	53	51	49	38	39	**	65	65	44	56	41	28	6	8	25	-11	1	57	40	38	34
22	-14	10	-33	10	-29	-4	-22	-10	-7	21	-11	1	52	55	30	59	38	38	24	45	65	**	62	66	35	55	24	21	-10	34	-8	0	38	45	38	39
23	-5	2	-37	12	-35	-4	-31	-14	18	20	-8	8	47	45	31	50	58	48	45	44	65	62	**	52	49	30	34	0	-5	27	-8	-6	47	42	43	32
24	-19	27	-29	15	-24	0	-21	-12	6	32	-14	5	52	50	33	62	28	45	31	44	44	66	52	**	24	53	15	14	-20	30	-25	-13	47	51	42	34
25	36	31	9	6	-6	10	3	9	27	18	17	12	48	28	58	45	66	38	37	40	56	35	49	24	**	46	43	10	22	31	6	24	40	31	44	28
26	6	40	6	20	-7	31	2	16	13	38	-3	23	41	62	35	53	21	39	10	43	41	55	30	53	46	**	18	45	14	43	10	25	40	63	51	46
27	12	12	-1	2	-8	-5	27	5	19	0	-1	0	30	25	40	34	38	42	49	38	28	24	34	15	43	18	**	7	16	18	50	31	32	24	32	26
28	4	30	14	42	-4	38	18	32	11	49	21	37	4	41	-3	20	0	13	-4	35	6	21	0	14	10	45	7	**	9	47	13	43	11	46	33	49
29	33	27	57	15	47	21	39	28	36	24	34	26	-3	2	31	-8	14	21	18	15	8	-10	-5	-20	22	14	16	9	**	1	42	43	12	9	13	21
30	12	33	6	39	-7	42	13	42	24	51	6	30	15	44	5	21	25	41	33	53	25	34	27	30	31	43	18	47	1	**	25	35	26	57	41	45
31	2	0	18	-4	17	22	46	20	14	3	2	11	-11	16	5	0	19	20	30	18	-11	-8	-8	-25	6	10	50	13	42	25	**	49	5	26	22	16
32	24	22	34	21	22	34	34	24	8	31	10	30	-10	26	10	0	12	34	21	36	1	0	-6	-13	24	25	31	43	43	35	49	**	10	34	35	45
33	3	23	-2	3	7	18	0	16	28	21	16	10	50	36	37	41	31	36	35	34	57	38	47	47	40	40	32	11	12	26	5	10	**	51	65	42
34	-7	26	-4	30	-13	35	-2	22	27	49	12	28	35	71	10	39	30	54	31	54	40	45	42	51	31	63	24	46	9	57	26	34	51	**	74	69
35	9	24	12	20	-3	31	3	18	18	29	11	24	36	59	19	38	43	52	45	56	38	38	43	42	44	51	32	33	13	41	22	35	65	74	**	61
36	-4	20	10	33	5	26	19	17	18	40	4	20	30	68	11	21	25	39	31	43	34	39	32	34	28	46	26	49	21	45	16	45	42	69	61	**

APPENDIX C: CORRELATION MATRIX OF THE CLEMSON SAMPLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	**	40	48	40	56	44	50	54	50	43	60	34	33	26	44	21	29	35	36	29	25	20	16	10	39	38	37	12	52	32	20	20	28	10	15	20
2	40	**	59	50	40	44	45	43	49	56	49	57	50	57	55	41	35	52	44	54	41	48	36	40	48	60	48	44	48	47	29	46	41	45	48	49
3	48	59	**	33	45	31	41	40	47	42	49	34	35	29	40	22	17	30	35	27	17	25	12	16	27	39	39	19	48	31	25	31	21	18	23	27
4	40	50	33	**	43	62	51	59	62	69	62	70	49	54	42	38	46	58	47	54	38	41	37	43	45	51	48	47	52	57	40	64	49	55	55	61
5	56	40	45	43	**	52	55	59	53	44	60	42	31	24	28	16	20	31	33	28	11	13	13	4	24	28	37	16	51	40	35	30	22	11	18	19
6	44	44	31	62	52	**	56	62	62	60	62	62	47	54	37	37	44	54	42	53	32	42	36	32	39	54	42	44	50	58	41	55	41	43	41	46
7	50	45	41	51	55	56	**	55	59	52	58	56	37	35	40	29	33	50	41	44	26	29	24	26	42	41	51	21	54	42	38	40	41	32	36	36
8	54	43	40	59	59	62	55	**	58	52	70	53	31	29	32	18	25	40	31	34	16	18	17	17	28	44	40	32	48	48	40	44	28	27	29	30
9	50	49	47	62	53	62	59	58	**	62	76	57	42	34	44	28	33	51	42	42	21	29	20	22	33	42	44	23	63	42	31	39	36	34	35	40
10	43	56	42	69	44	60	52	52	62	**	61	66	57	59	44	44	48	60	47	54	38	48	40	53	50	55	49	47	54	64	42	55	46	59	53	60
11	60	49	49	62	60	62	58	70	76	61	**	53	38	33	42	25	31	47	40	41	26	26	25	17	36	42	48	23	56	42	39	38	37	26	27	34
12	34	57	34	70	42	62	56	53	57	66	53	**	49	51	43	38	42	59	42	56	34	46	36	39	46	55	63	47	47	58	38	59	44	57	54	49
13	33	50	35	49	31	47	37	31	42	57	38	49	**	64	53	68	57	62	57	60	63	63	62	62	65	58	43	43	56	44	20	40	52	55	52	60
14	26	57	29	54	24	54	35	29	34	59	33	51	64	**	55	61	56	65	51	66	57	72	57	62	58	67	48	52	47	52	31	51	52	67	64	71
15	44	55	40	62	28	37	40	32	44	44	42	43	53	55	**	57	55	63	61	62	59	50	49	45	63	60	52	39	55	40	27	60	49	68	46	46
16	21	41	22	38	16	37	29	18	28	44	25	38	68	61	57	**	58	64	58	60	68	65	64	62	61	52	44	42	46	37	25	39	52	54	49	52
17	29	35	17	46	20	44	33	25	33	48	31	42	57	56	55	58	**	64	66	63	65	55	65	59	65	54	53	40	50	50	32	42	63	58	56	55
18	35	52	30	58	31	54	50	40	51	60	47	59	62	65	63	64	64	**	65	72	61	64	55	57	67	58	57	43	68	54	39	55	59	65	57	60
19	36	44	35	47	33	42	41	31	42	47	40	42	57	51	61	58	66	65	**	54	53	52	48	49	56	51	50	29	64	46	32	40	54	47	48	51
20	29	54	27	54	28	53	44	34	42	54	41	56	60	66	62	60	63	72	54	**	66	62	54	54	64	57	55	48	54	54	33	55	55	59	56	54
21	25	41	17	38	11	32	26	16	21	38	26	34	63	57	59	68	65	61	53	66	**	65	74	58	73	49	42	36	43	35	21	38	58	53	50	55
22	20	48	25	41	13	42	29	18	29	48	26	46	63	72	50	65	55	64	52	62	65	**	67	64	58	58	32	43	47	38	20	43	50	59	52	61
23	16	36	12	37	13	36	24	17	20	40	25	36	62	57	49	64	65	55	48	54	74	67	**	64	63	54	36	39	41	32	16	36	58	56	52	55
24	10	40	16	43	4	32	26	17	22	53	17	39	62	62	45	62	59	57	49	54	58	64	64	**	54	56	34	47	39	47	21	41	51	70	65	67
25	39	48	27	45	24	39	42	28	33	50	36	46	65	58	63	61	65	67	56	64	73	58	63	54	**	58	53	36	58	60	24	41	59	53	48	52
26	38	60	39	51	28	54	41	44	42	55	42	55	58	67	60	52	54	58	51	57	49	58	54	56	58	**	44	49	50	51	33	56	50	59	56	54
27	37	48	39	48	37	42	51	40	44	49	48	43	43	48	52	44	53	57	50	55	42	32	36	34	53	44	**	33	52	49	46	50	49	44	46	43
28	12	44	19	47	16	44	21	32	23	47	23	47	43	52	39	42	40	43	29	48	36	43	39	47	36	49	33	**	24	54	37	54	35	56	53	49
29	52	48	48	52	51	50	54	48	63	54	56	47	56	47	55	66	50	68	64	54	43	47	41	39	58	50	52	24	**	41	33	41	50	41	41	49
30	32	47	31	57	40	58	42	48	42	64	42	58	44	52	40	37	50	54	46	54	35	38	32	47	40	51	49	54	41	**	54	60	46	59	56	51
31	20	29	25	40	35	41	38	40	31	42	39	38	20	31	27	25	32	39	32	33	21	20	16	21	24	33	46	37	33	54	**	56	36	36	34	34
32	20	46	31	64	30	55	40	44	39	55	38	59	40	51	40	39	42	55	40	55	38	43	36	41	41	56	50	54	41	60	56	**	44	60	53	55
33	28	41	21	49	22	41	41	28	36	46	37	44	52	52	49	52	63	59	54	55	58	50	58	51	59	50	49	35	50	46	36	44	**	62	63	55
34	10	65	18	55	11	43	32	27	34	59	26	57	55	67	68	54	58	65	47	59	53	59	56	70	53	59	44	56	41	59	36	60	62	**	80	70
35	15	48	23	55	18	41	36	29	35	53	27	54	52	64	46	49	56	57	48	56	50	52	52	65	48	56	46	53	41	56	34	53	63	80	**	64
36	20	49	27	61	19	46	36	30	40	60	34	49	60	71	46	52	55	60	51	54	55	61	55	67	52	54	43	49	49	51	34	55	55	70	64	**