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ABSTRACT

The relationship between self-efficacy/interests and college major was the focus of a study. A sample of 760 midwestern college students reported their present college major on a demographic questionnaire and completed either the research version of the 1994 Strong Interest Inventory (SII) or the actual 1994 SII and the 1996 Skills Confidence Inventory (SCI). The students were divided into six groups based on categories of college majors that were formulated by using Holland's six general occupational themes (GOTs): realistic, investigative, artistic, social, enterprising, and conventional. Twelve univariate analyses of variance were used to determine the extent to which the GOTs and the six general confidence themes (GCTs) included on the SCI contributed to the separation of students into six groups. F ratios were calculated to determine significance, and Wilks' lambdas were calculated at the univariate level to determine effect sizes for each GOT and GCT. Results suggest that self-efficacy and interests are related to college major in accordance with Holland's typology. The six SII GOTs and the six SCI GCTs predicted Holland majors. Combined, the GOT and GCT have even greater discriminant power. (Contains 12 references) (MN)

Self-efficacy and Interests: Relationships of Holland Themes to College Major

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ABSTRACT

The 1994 Strong Interest Inventory revision and the companion 1996 Skills Confidence Inventory provide opportunities to examine the influence of career self-efficacy and interests on career choices. Within Holland's theory they jointly measure six General Occupational Themes (GOTs) and six General Confidence Themes (GCTs). This study examined the relationship of self-efficacy and interests to college major using a sample of 760 midwestern college students. College majors were grouped in the six Holland types. Results from both univariate and multivariate analysis suggest that self-efficacy and interest are related to college major in accordance with the theoretical framework of Holland's typology. Discriminant function hit-rates for predicting the six Holland majors from the 6 GOTs, 6 GCTs, and 12 GOTs and GCTS combined were, respectively, 42.1%, 47.4%, and 49.2%.

INTRODUCTION

Historical development in interest measurement, most notably by E.K. Strong, has been largely empirical, with little theoretical or conceptual base (Donnay, in press). Self-efficacy, on the other hand, originated with Bandura's 1977 theory and then was applied by Hackett and Betz (1981) to career behavior. Most recently, important theoretical work to merge the concepts of interests and self-efficacy has been advanced by Lent, Brown, and Hackett(1994). Thus, we may be on the threshold of an enhanced understanding of vocational interests because of the theorizing based on self-efficacy theory. Moreover, we are at a point where empirical work is now needed to test and refine the emerging formulations about the interactions of influences among interests, self-efficacy, and career behavior.

Vocational psychology's most enduring and influential theoretical model perhaps has been Holland's theory of vocational personalities and work environments. In 1972, Strong's empiricism and Holland's theory were merged in the Strong Interest Inventory(Campbell & Holland, 1972). The six General Occupational Themes(GOTs) were added to the Strong, and Holland's theory and it's counseling applications became the central organizing principle of the Strong. Many other inventories are now similarly organized.

Recently the Strong has been expanded to measure self-efficacy within the dimensions of Holland's theory. As a companion instrument to the SII, Betz, Borgen, and Harmon(1996) created the Skills Confidence Inventory(SCI) to measure self-efficacy for the Holland themes. Called the General Confidence Themes (GCTs), these measures of career self-efficacy are closely articulated with the parallel GOT measures of interests (Harmon, Borgen, Berreth, King, Shauer, & Ward, 1996). Betz, Harmon, and Borgen (1996) described the initial validation work with the SCI, with criterion groups based on occupational membership. This presentation now extends that work by examining the relationships of self-efficacy and interests to the criterion groups of college major, and by analyzing the relationships within the framework of Holland's theory. Our findings about college major as a construct are expected to mesh theoretically with other work on occupations, inasmuch as each domain is related to work environments within Holland's theory. Also, a focus on college major promises to have direct counseling applications in helping clients and counselors understand the psychological worlds -- of confidence and interest -- that demarcate choice, success, and persistence in a college major.

METHOD

Participants

This study consisted of 912 midwestern college students who had completed either the research version of the 1994 Strong Interest Inventory or the actual 1994 Strong Interest Inventory (SII), and the 1996 Skills Confidence Inventory(SCI). In addition, 760 of the 912 college students reported their present college major on a demographics questionnaire. Gender subgroups within the entire sample moderately differed in number with women outnumbering men 585 to 314, respectively. The group of 760 who had reported their major were used for both the univariate and multivariate analysis.

Predictive Measures

Strong Interest Inventory. There are three kinds of scales within the 1994 Strong Interest Inventory (Harmon et al, 1994) : (1) Basic Interest Scales, (2) General Occupational Theme Scales (GOTs), and (3) Personal Styles Scales. Our study focuses on the GOTs and their relationship to the SCI and college major. There are six GOTs : (1) Realistic, (2) Investigative, (3) Artistic, (4) Social, (5) Enterprising, and (6) Conventional (See FIGURE 1). Each GOT has a mean of 50 and a standard deviation of 10.

Skills Confidence Inventory. The 1996 Skills Confidence Inventory (Betz, Borgen, & Harmon, 1996) contains six General Confidence Themes(GCTs), which parallel the six GOT of the Strong Interest Inventory. The combination of GOTs and GCTs will give us a look into the complex relationships that take place between interest and confidence, and how those relationships are meaningful when talking about college majors.

Criterion Groups

The criterion groups for this study consisted of six categories of college majors. Subsample sizes for each major group are presented in Tables 2 and 3 along with their mean scores on the six themes of both the GOTs and GCTs. These six categories were created in accordance with Holland's six general themes. In grouping the majors for our sample, we referred to the Holland Self-Directed Search College Major Finder (Rosen, Holmberg, & Holland, 1989) which allowed us to place each major into its suggested Holland type.

Analysis

Twelve univariate ANOVAs were used to determine the extent to which each of the six GOTs and GCTs contributed to the separation of our six college groups. F Ratio's were calculated to determine the significance. Wilks's lambdas were also calculated at the univariate level to examine the effect sizes for each of the six GOTs and GCTs. Wilks's lambda can be defined as the within groups sums of squares over the total sums of squares.

Wilks's lambda reveals the proportion of variance not explained by the predictor variables on the criterion group. In our univariate analysis, one minus Wilks's lambda gives us the proportion of variance explained in college major groups by each of the six GOTs and GCTs.

Multivariate discriminant analysis were also conducted to determine the extent which the entire GOT and GCT scales could discriminate between our six college major categories. Three predictor sets were used in these analysis: (1) GOTs, (2) GCTs, and (3) Combined GOTs and GCTs. Wilks's lambda in the multivariate case takes into account all themes simultaneously on both the GOT and GCT. We expect to find that both the GOT and GCT scales will explain a significant amount of the variance in the data when investigated separately. In addition, we hope to find the combination of the two scales will explain a greater portion of the variance than either of the two scales taken alone.

Beyond our calculations of Wilks's lambda and F-ratios, we also calculated hit rates for each of the scales by themselves and taken together. Hit rates indicate the percentage of correct classifications into the actual college major groups using the discriminant functions. We expect to find significantly high hit rates for both the GOT and GCT scales when analyzed as separate sets, and even higher hit rates when examined together.

RESULTS

Correlation Analysis

Pearson product correlations were calculated between the each of the six theme scales on both the GOT and GCT scales. The results are presented in the correlation matrix in Table 1. The values for matching interest and confidence themes are highlighted in red.

Univariate Analysis

Results from the twelve ANOVAs indicate significant effect sizes at the p=.0005 level for each of the six themes for both the GOTs and GCTs (see Table 4). Wilks's lambdas for the GOT scale ranged from .86636 for the realistic family to .91842 for the conventional. For the GCT scale we find ranges of .84455 for the social theme to .94755 for the investigative. From the above ranges, we can see that some variables explained more of the variance in the data than others. Again, the lower the value of the Wilks's lambda, the more variance in the data that is explained by that particular variable. Interpretation of these Wilks's lambdas suggests that the social theme on the GCT scale explains more of the variance, over 15%, than any of the other 11 themes. Using Cohen's (1988) standard for effect sizes, accounting for 15% of the variance is considered a large effect size. The effect sizes for 10 of the 12

themes were at least at the moderate level, accounting for 6% or more of the variance in the data.

Multivariate Analysis

Multivariate discriminant analysis was carried out on both the GOT scales of the Strong and the GCT scales of the Skills Confidence Inventory. In addition, discriminant analyses were run on both the GCT and GOT scales taken together. Results for the multivariate analysis on the GOTs are presented in Table 8. We find the GOT scale as a whole explains a significant (p <.0001) portion of the variance in college major membership. Wilks's lambda for the entire GOT scale was .5293, meaning it explained nearly 48% of the variance in college major group membership. Discriminant analysis of the GOTs, GCTs, and the combined GOT-GCT scales resulted in five significant discriminant dimensions.

For the GCT scales, we also find a significant ($p < .0001$) portion of the variance in college major membership accounted for (see Table 9). With all six themes taken into account, the GCTs had a Wilks's lambda of .5148, or almost 49% of the variance in college major membership accounted for.

The third multivariate discriminant analysis took into account both the GOT and GCT scales simultaneously. What we find when both are taken into account is nearly a 10% increase in the variance explained for college major membership. Discriminant results for the COMBINED analysis are presented in Table 10. Wilks's lambda for all 12 themes was .4295 with nearly 58% of the variability in college major membership explained. The decrease in the value of Wilks's lambda is the outcome we had expected when comparing the GOT and GCT scales taken separately with them taken together.

The discriminant abilities of each scale, both in isolation and combined can be plotted in space. An example of the discriminant abilities of the two sets of scales combined is presented in Figure 3. Each dot on the graph represents the mean, or centroid, of all the data points for each college major group. The underlying dimensions for such graphs can be seen in Tables 5, 6, and 7. When looking at the tables notice functions 1 and 3. For function 1 we find that realistic and social themes are on opposites ends of the correlational spectrum. This can be applied to Holland's hexagon in Figure 1, where we find realistic and social themes on opposite ends of the hexagon. In function 3 we find this same effect between the artistic and conventional themes.

Hit rates. Hit rates for each of our three predictor sets were calculated. For the GOTs alone we find a hit rate of 42.11%. This was slightly lower than the hit rates we found for the GCTs taken alone, which was 47.37%. Hit rates for the combination of the two scales was

somewhat larger than for the GOT scale, and only slightly larger than for the GCT scale. This minute increase in the percent of direct hits on the correct college major type when moving from the two scales taken alone to them taken together does not agree with our expectations. The fact that the combination of the two scales did provide a somewhat larger increase in explained variance but only a slight increase in hit rate percentage may be a result of the unequal subsample sizes for the six college major types. Hit rates for each of the three predictor sets are presented in Tables 8, 9, and 10.

Probability of group membership was determined by standardizing the mean theme scores for the GOT and GCT scales. These scores were then plotted in three dimensional space along a third axis which is labeled with a dummy variable. The dummy variable gave a value of one for membership in the major type of interest, and a value of zero for all persons not in that major type. An example of one such graph is presented in Figure 2. This graph shows the probability of membership in a social major based on standardized social interest and confidence scores. The plane of the graph runs along the mean of the dummy variable at all standardized values of interest and confidence. If there are more values of "1" at a particular interest and confidence value than there are "0", there is an increase in the probability of membership. So an increase in the number of persons in a social major at a particular value of interest and confidence increases the probability value of being in a social major at that level of interest and confidence.

DISCUSSION

This study examined the concurrent validity of the Strong Interest Inventory and the Skills Confidence Inventory for predicting college major. The concurrent validity of these measures becomes more apparent as we find that our results parallel those of studies that have used occupation as a criterion group (Donnay and Borgen, 1996) as opposed to our college major types. Both the GOT and GCT were clearly strong in their ability to discriminate among the six major types. Taken together we find that their discriminant power is even greater. This is consistent with our hypothesis that both kinds of scales will relate to college major in theoretically meaningful ways.

The predictive power of these two scales, as indicated by hit rate values, shows these two scales to be powerful predictors by themselves. Taken together we found only a slight in crease in predictive power, but this lack of increase in predictive ability may be due to the inequalities in subsamples sizes for the six major types.

The implications of this study such as this can be immediate. The use of theoretical knowledge that comes from the results can be applied in a career and college counseling setting. The underlying dimensions of the Strong and Skills Confidence Inventory can benefit clients in these settings by helping them determine which types of majors or careers may best coincide with their personality type.

Correlations Between Interest and Confidence Across Holland's Six General Themes

		INTEREST					
		REAL.	INVEST.	ART.	SOCIAL	ENTER.	CONV.
CONFIDENCE	REAL.	.710**	.327**	.095**	-.027	-.021	.008
	INVEST.	.356**	.689**	.096**	-.074*	-.126**	.097**
	ART.	.101**	.123**	.690**	.170**	.015	-.121**
	SOCIAL	-.099**	.041	.251**	.523**	.097**	-.051**
	ENTER.	.172**	.078*	.100**	.095**	.389**	.158**
	CONV.	.312**	.263**	-.105**	-.079*	.290**	.517**

N = 912

Table 1

Holland's General Occupational Themes

- Realistic
- Investigative
- Artistic
- Social
- Enterprising
- Conventional

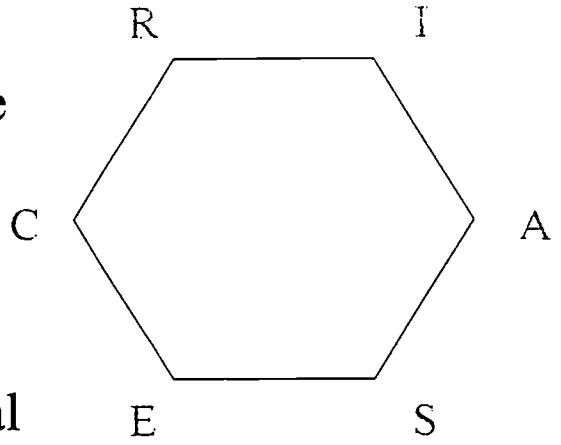


Figure 1

MEANS FOR SIX MAJOR TYPES ON EACH OF HOLLAND'S GENERAL OCCUPATIONAL THEMES

		Six General Occupational Themes					
Major Type	N	Real.	Invest.	Art.	Social	Enter.	Conv.
Realistic	37	57.76	48.43	38.95	46.46	48.43	50.57
Investigative	150	47.52	50.09	42.70	50.11	48.82	49.21
Artistic	47	44.66	42.15	54.68	50.94	50.09	45.98
Social	388	42.70	44.04	48.60	56.41	50.39	47.97
Enterprising	125	46.28	42.26	44.23	50.09	58.15	53.82
Conventional	13	41.23	41.69	41.00	48.92	57.92	63.77
Total	760	45.07	45.00	46.49	53.17	51.37	49.45

Table 2

MEANS FOR SIX MAJOR TYPES ON EACH OF THE GENERAL CONFIDENCE THEMES

		Six General Confidence Themes					
Major Type	N	Real.	Invest.	Art.	Social	Enter.	Conv.
Realistic	37	3.85	3.48	2.56	3.29	3.45	3.69
Investigative	150	3.17	3.30	2.71	3.42	3.04	3.12
Artistic	47	3.28	3.01	3.86	3.50	3.31	3.04
Social	388	2.99	2.97	3.07	3.99	3.11	2.93
Enterprising	125	3.05	2.83	2.84	3.46	3.52	3.47
Conventional	13	2.69	2.93	2.62	3.35	3.30	3.87
Total	760	3.09	3.04	2.98	3.71	3.20	3.12

Table 3

Univariate Analysis of Group Separation for Interest and Confidence: Wilks's Lambda and F Ratio

	Wilks's Lambda	F(5, 754)	*p*
INTEREST			
Realistic	.86636	23.2224	.0001
Investigative	.90989	14.9343	.0001
Artistic	.87876	20.8062	.0001
Social	.90399	16.0168	.0001
Enterprising	.90539	15.7582	.0001
Conventional	.91842	13.3951	.0001
CONFIDENCE			
Realistic	.93702	10.1361	.0001
Investigative	.94755	8.3469	.0001
Artistic	.88386	19.8156	.0001
Social	.84455	27.7558	.0001
Enterprising	.94092	9.4679	.0001
Conventional	.88361	19.8638	.0001

Table 4

Structure Matrices Showing Pooled Within-Groups Correlations Between General Occupational Themes and Discriminants

(N = 760)

Theme	Func 1	Func 2	Func 3	Func 4	Func 5
Realistic	.5746	-.2226	.5473	.2253	.0138
Investigative	.2405	-.5697	-.1365	-.4036	-.0051
Artistic	-.5687	.1608	.4336	-.2717	.0378
Social	-.4997	-.0621	-.2438	.6046	.1086
Enterprising	.1539	.6196	-.2591	.1053	.4889
Conventional	.3221	.3844	-.4375	.0641	-.3983

Table 5

Structure Matrices Showing Pooled Within-Groups Correlations Between General Confidence Themes and Discriminants

(N = 760)

Theme	Func 1	Func 2	Func 3	Func 4	Func 5
Realistic	**-.2309**	**-.2174**	**.3865**	**.7222**	**.4706**
Investigative	**-.1300**	**-.4504**	**.2856**	**-.0295**	**.4618**
Artistic	**.3291**	**.4703**	**.6347**	**.2225**	**.3125**
Social	**.6181**	**.0296**	**-.3861**	**.4736**	**.2046**
Enterprising	**-.2538**	**.3742**	**-.0952**	**.5000**	**.1102**
Conventional	**-.5258**	**.1734**	**-.2216**	**.1279**	**.6998**

Table 6

Structure Matrices Showing Pooled Within-Groups Correlations Between **Combined** Interest and Confidence and Discriminants

(N = 760)

Theme	Func 1	Func 2	Func 3	Func 4	Func 5
INTEREST					
Realistic	**.5324**	**.0714**	**.1270**	**.8075**	**.0404**
Investigative	**.0236**	**.6495**	**-.1012**	**.8053**	**.5801**
Artistic	**.2975**	**.2574**	**.1493**	**.3944**	**.0373**
Social	**.1303**	**.2653**	**.0258**	**.1079**	**.0284**
Enterprising	**.1466**	**.2615**	**-.2241**	**.4058**	**.8111**
Conventional	**.0786**	**.2910**	**-.2452**	**.1007**	**.9472**
CONFIDENCE					
Realistic	**.2094**	**.2071**	**.1859**	**.0043**	**.0357**
Investigative	**.0123**	**.1746**	**.1227**	**.1393**	**.4673**
Artistic	**.1310**	**.3995**	**.5901**	**.5440**	**.1934**
Social	**.5893**	**.0479**	**-.5840**	**.4861**	**.0442**
Enterprising	**.3573**	**.1270**	**.1459**	**.2120**	**.3092**
Conventional	**.3420**	**.2912**	**-.1844**	**.1893**	**.1751**

Table 7

Discriminant Function Results For:

GENERAL OCCUPATIONAL THEMES

Discriminant Function	% of variance	Canonical correlation	After function removed	Wilks's Lambda	*p*
			0	.5293	< .0001
1	49.61	.5109	1	.7164	< .0001
2	31.03	.4254	2	.8747	< .0001
3	11.60	.2763	3	.9470	< .0001
4	4.60	.1781	4	.9780	< .0005
5	3.15	.1482			

Hit Rate = 42.11%

Table 8

Discriminant Function Results For:

GENERAL CONFIDENCE THEMES

Discriminant Function	% of variance	Canonical correlation	After function removed	Wilks's Lambda	*p*
			0	.5148	< .0001
1	55.52	.5432	1	.7304	< .0001
2	24.59	.3955	2	.8658	< .0001
3	13.96	.3086	3	.9569	< .0001
4	4.66	.1842	4	.9905	< .05
5	1.27	.0973			

Hit Rate = 47.37%

Table 9

COMBINED
Discriminant Function Results For:
INTEREST AND CONFIDENCE THEMES

Discriminant Function	% of variance	Canonical correlation	After function removed	Wilks's Lambda	*p*
			0	.4295	< .0001
1	51.50	.5790	1	.6461	< .0001
2	26.63	.4548	2	.8146	< .0001
3	11.90	.3231	3	.9095	< .0001
4	7.15	.2559	4	.9732	< .01
5	2.81	.1636			

Hit Rate = 49.21%

Table 10

Likelihood of Membership in a Social Major

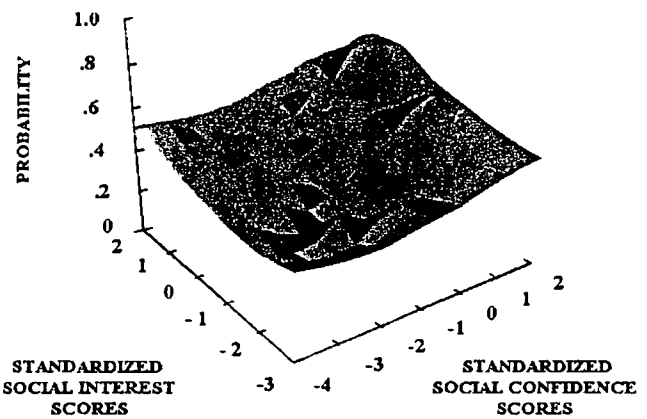


Figure 2

COMBINED GOT and GCT Scales: Six Major Types in Discriminant Space

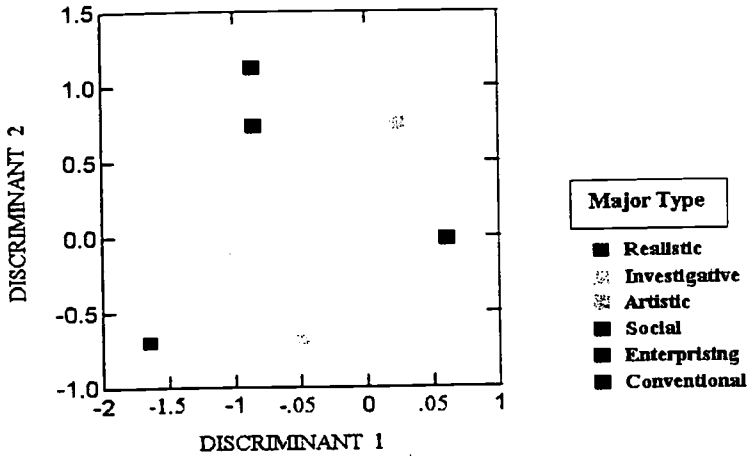
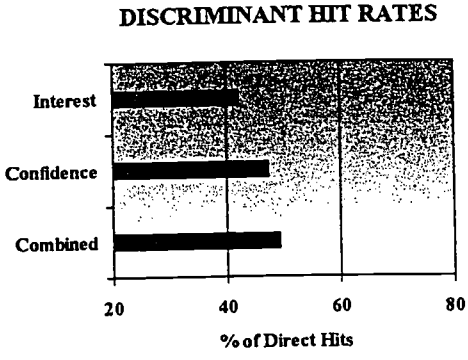


Figure 3

HIGHLIGHTS OF OUR STUDY

- Holland's theory applies to college majors, for both interest and confidence
- 6 Strong GOTs clearly predict Holland majors
- 6 Skills Confidence Inventory GCTs clearly predict Holland majors
- 12 combined GOTs and GCTs predict Holland majors somewhat more strongly



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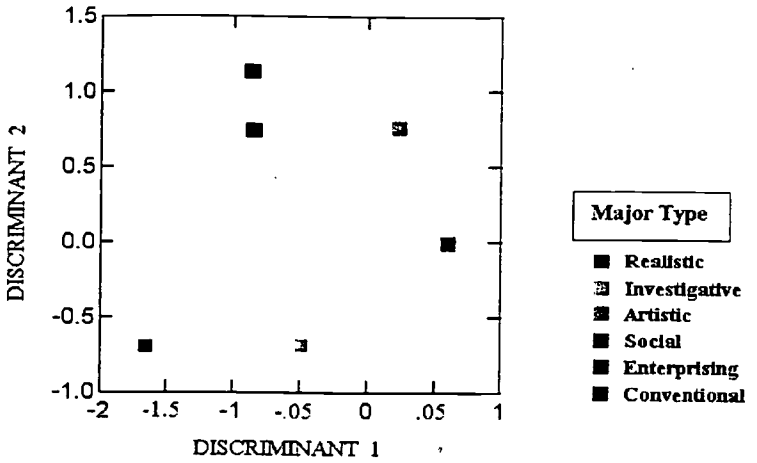

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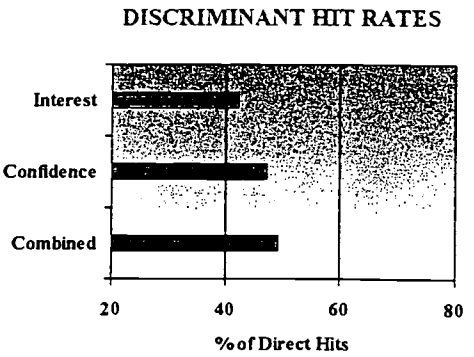

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