CCC trigrams of low association value: A re-evaluation¹

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The 343 CCC trigrams having the lowest association values in Witmer's 1935 list were re-evaluated. Reliability of ratings was .89 and the correlation with Witmer's values was .79. Large changes were found in trigrams such as JFK, QJF, LBJ, LBH, HFC, GXM, DHJ, DXB, etc. There were substantial increases in values of trigrams beginning with D. New norms are presented for experimenters who need more precise control over stimulus materials.

Investigators of short-term memory, paired-associate learning and other processes, often use low association value CCC trigrams as their stimulus material (Peterson & Peterson, 1959; Bruce & Cofer, 1965). Since the only available association values for CCC trigrams are those published by Witmer in 1935, the investigator who wishes to obtain precise control over association values encounters difficulties. While it may be true that considerable stability in association value, meaningfulness, frequency, etc., has been found when words or CVC trigrams were studied (Goss & Nodine, 1965; Underwood & Schulz, 1960; Spreen & Schulz, 1966), a casual inspection of Witmer's list produces obvious evidence of striking changes which have occurred over the last 30 years, suggesting that trigrams may not be as stable as some other verbal materials. For example, 30 years ago, under a different president, 71% of Witmer's Ss could think of an association for FDR but only 29% found LBJ meaningful. Before football and communist subversion became so highly organized, only 25% of Ss reported associations for NFL and in days when the financing of homes and a certain company's automobiles may have been less frequent, HFC and GXM had only 4% association values.

An investigator may reduce the variability in meaningfulness of his stimulus materials by eliminating trigrams which have obviously changed in association value, but this intuitive approach cannot lead to the elimination of trigrams which have changed in value due to more subtle associations. If investigators in short-term memory, or other areas, are to have available stimulus materials of uniform low association value, it seems essential to establish new norms.

The present study was undertaken to identify changes that have occurred over the past three decades and to make available to present investigators the new norms for low association-value CCC trigrams.

Method. The Ss were 80 students enrolled in introductory psychology classes at the University of Bridgeport. The Ss were divided into eight groups of approximately 20 Ss per group. Each group participated in one experimental session which consisted of rating 200 trigrams.

The 343 trigrams having the lowest association values in Witmer's list (0 to 17%) were selected for re-evaluation. The rating method which Noble, Stockwell, & Pryor (1957) introduced was employed. Each trigram was flashed upon a screen for 5 sec with an opaque projector. Ss were instructed to rate each trigram using a 5-point scale, indicating how many associations, ideas, or things it made them think of. The 5-point scale, printed at the top of each sheet, was as follows: 1 = none, 2 = below average, 3 = average, 4 = above average, 5 = very many. Ss were directed to use the following procedure: (a) Write down the trigram, (b) decide which category on the 5-point scale was most appropriate for the trigram, (c) write down the number of that category next to the trigram, (d) cover the rated trigram and its rating with a mask (provided to reduce sequence effects) and prepare for the next trigram. Three practice examples were given and Ss were permitted to ask questions.

In order to assess the reliability of the ratings, 50 trigrams were repeated in the list, bringing the total list of trigrams to 393.

In previous studies of syllables, randomization has been limited to the counterbalancing of pages, the order of trigrams on each page remaining the same throughout. A number of investigators have expressed dissatisfaction with this procedure (Loess & Nodine, 1965), suggesting that order effects may influence the ratings of some trigrams. Therefore, to control for the occurrence of order effects four different random lists of the 393 trigrams were produced by an IBM 1620 computer, using a 3-digit random number generator. Each of the four lists was divided in half and each half was given to a group of approximately 20 Ss for rating. Thus, each of the 393 trigrams received ratings from about 80 Ss.

Results and Discussion. A reliability correlation of .89 was found between ratings of the 50 trigrams which were repeated in each list, indicating that the rating method was reliable. A Pearson Product Moment correlation of .79 was found between Witmer's association values and those obtained in the present study. This value seems reasonably high if we consider that the distribution of association values was drastically truncated by selecting a narrow range of values.

As expected, individual trigrams have changed in association value over the past 30 years. For example, HFC, which received a higher rating than 98.8% of the 343 trigrams in the present study, received a rating higher than only 6.7% of the same 343 trigrams in the Witmer study. GXM received a rating higher than 6.9% of the 343 low association value trigrams in the Witmer study and 72.8% of the same trigrams in the present study.

Some changes seemed related to the presence of meaningful consonant pairs. Trigrams with any combination of two consonants from JFK or LBJ showed striking increases in association value (e.g., QJF, BFK, FSJ, LBH, and HBJ).

Other trends were found for which the explanations are not so obvious. For example, there were substantial increases in association values for those trigrams beginning with the letter D.

The results indicate that important changes have occurred in the association values of CCC trigrams over the past 30 years. Investigators who need more precise control over association value of CCC trigrams may wish to re-evaluate trigrams or to select trigrams from the new norms which are presented here.

Table 1 (on the next page) presents the 343 trigrams which were selected from Witmer's (1935) list (0 to 17% association values). The trigrams are listed here in rank order from lowest association value to highest association value, as rated in the present study.

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Table 1
New Norms for Low Association-value CCC Trigrams

0 to 20%	21% to 40%	41% to 60%	61% to 80%	81% to 100%
CGQ	ZJH	FPW	KXC	MJF
XKQ	ZSJ	GCQ	QDJ	MWB
JQZ	ZHW	KHQ	XHM	MGQ
XQG	ZGF	FWQ	ZBQ	JQF
HXJ	FQJ	ZQW	WZQ	CWH
ZQC	KZF	KFQ	CFQ	SJF
GCZ	ZXH	FCQ	QMW	MHB
ZJX	ZMX	ZGX	QBJ	TFJ
HXQ	HXB	XNZ	TZQ	XBJ
ZXJ	MHZ	CXZ	ZXR	DHJ
GZQ	XQF	GQC	GKQ	DJZ
XZQ	HXF	ZTK	ZFW	ZBF
QXH	ZHX	DQH	CJZ	BHJ
XBN	CXQ	QJS	HFJ	MHJ
XSZ	QXF	CJQ	CZF	DJH
ZXC	ZKH	QGZ	BQF	JXF
GXZ	ZJT	BQZ	MZB	JDW
QXJ	KZS	GCJ	WCQ	JDF
ZQJ	KZX	XFH	JXB	DJB
QCX	ZQH	CQZ	TZF	FPJ
XZK	KZG	FQC	KQW	DJS
ZCK	QFZ	FJZ	XQB	MFH
CXQ	QWJ	FXQ	MQB	MBX
KZH	XFQ	ZTF	XBF	HBM
ZXF	GXX	KQH	ZBJ	HJC
XQD	KXQ	KQZ	KXN	LJF
ZXD	TZH	QJF	QJC	JSB
ZJQ	ZJF	ZDH	KXB	WBF
ZWJ	XFZ	CZJ	XTG	BWF
XZJ	GXZ	QCF	KHB	KBF
ZSQ	ZTX	MWZ	BJQ	DJW
XZF	XKH	ZQG	JQW	JDH
CJX	ZDW	QFH	SBZ	MCF
QGJ	GXC	QZB	FJH	XDJ
XGZ	JQH	FJQ	KHF	JHW
ZGW	CXJ	WQH	MWB	MPH
GZK	JXQ	ZJC	QHF	LHJ
XTJ	ZFJ	JXH	QXL	HBJ
XZC	XGC	ZLC	XDH	HWC
ZWQ	FQH	ZQF	DJQ	HFK
GXJ	QHJ	XFP	TFQ	MWF
ZTF	QZH	JTQ	XJF	JBP
GQK	ZQB	QFC	GXM	WBH
XQJ	KQX	QDX	HKM	JFM
GCX	SZJ	HZW	QHN	JFQ
GKX	XGK	XJF	CHJ	JCF
XBQ	CQK	MZJ	WBQ	BJH
ZKG	KXZ	QFX	XKB	BPJ
QZJ	XZD	GQB	CXF	JHC
QLJ	GQH	KXD	XFk	JHF
ZQS	KWQ	ZFK	LJX	WFC
QGC	XFJ	QXM	GZB	JFC
XGQ	HJX	KXR	DXJ	JFN
ZXB	XCJ	HCZ	FJC	HFM
XQF	QGW	XGP	KMF	BFM
XQH	CXK	XHF	MHW	JFH
XQL	CQJ	ZBG	TJW	LCF
ZCX	GJX	JZH	FJS	FPC
ZHK	ZQX	KFX	GJC	BFM
QKB	KQM	XJB	FHJ	WCF
CQJ	KXH	XJH	GCJ	KBF
XJQ	XMZ	ZFC	FJW	MPW
ZHJ	CXF	ZBH	HJF	WBJ
ZCJ	BQJ	CGJ	MHF	FHC
ZXG	ZXK	FCJ	KBH	BMF
XHJ	MQJ	KQB	FWJ	HFC
ZFQ	QZM	XFS	SBQ	
FQW	KHZ	FQK	ZMC	
QSJ	QJF	HCJ	CFJ	