Data collected in the fall of 1970 by Professor Douglas P. Ferraro (Ferraro and Billings, in press, a, b) on drug use among undergraduates at the University of New Mexico will serve to illustrate the use of canonical analysis in uncovering interesting relationships between two sets of variables. The items on this anonymous questionnaire included a number of questions on general drug use (from cigarettes to "hard" narcotics such as heroin), as well as a set of questions explicitly directed toward marijuana usage and a number of questions tapping general background variables (age, sex, etc.). These data thus afford the opportunity to investigate (among other things) the extent to which various constellations of background variables are predictive of drug use. Focusing on marijuana for the moment, Table 5.1 reports the

correlations between eight background variables (sex, age, class in school, parents' annual income, degree of religious activity, political activity, degree of agreement with parents on Vietnam, and degree of agreement with parents on premarital sex and abortion) and six questions pertaining to marijuana usage (how often the respondent had smoked marijuana, the age when he had first smoked it, how frequently he currently smoked it, whether he would use it in the future if he had the chance, whether he feels pot use should be restricted to those 18 years of age or older, and whether he feels marijuana use should be legalized).

Table 5.1

Correlations of Background Variables with Marijuana Questions[a]

Background variables	Marijuana questions					
	Nmarij	FstMarij	NowUseMj	WldUseMj	RestrMj	LegalMj
Sex	−.186	.174	−.171	.144	.034	−.079
Age	−.080	.202	−.083	.057	−.107	−.052
Class	−.005	.144	−.026	−.008	−.052	.043
Pannuinc	.101	−.102	.109	−.084	.009	.052
ReligAct	.389	−.319	.325	−.349	.100	.329
YrPolAct	−.150	.117	−.136	.125	−.033	−.132
AgrPVN	−.174	.134	−.162	.206	−.067	−.195
AgrPSex	−.261	.246	−.200	.272	−.072	−.308

[a] The questions and the available responses were as follows:

Sex: 0 = Male, 1 = Female.

Age: 0 = ≤ 17, 1 = 18, 2 = 19, etc.

Class: 0 = Freshman, 1 = Sophomore, . . . , 4 = Graduate student.

Pannuinc (Parents' annual income): 0 = < $5000, 1 = $5–10,000, . . . , 4 = > $25,000.

ReligAct ("How active are you in your religion?"): 0 = Very active, 1 = Active, 2 = Barely active, 3 = Inactive.

YrPolAct ("How active are you politically?"): 0 = Very active, ... 3 = Inactive.

AgrPVN ("Do you agree with your parents on Vietnam?"): 0 = Strongly disagree, 1 = Generally disagree, 2 = Do not know, 3 = Generally agree, 4 = Strongly agree.

AgrPSex ("Do you agree with your parents on premarital sex and abortion?"): 0 = Strongly disagree, . . . , 4 = Strongly agree.

NMarij ("How many times have you used marijuana?"): 0 = Never, 1 = 1 time, 2 = 2–4 Times, 3 = 5–14 Times, 4 = 15–30 Times, 5 = More than 30 times.

FstMarij ("When did you first use marijuana?"): 1 = Elementary school, grades 1–6; 2 = Junior high school, grades 7–9; 3 = High school, grades 10–12; 4 = College, fresh year; . . . ; 7 = College, senior year; 8 = Have never used.

NowUseMj ("How often do you currently use marijuana?"): 0 = Do not use marijuana, 1 = Less than once per month, 2 = 1–4 Times per month, 3 = 1–3 Times per week; 4 = 4–6 Times per week; 5 = 7 or More times per week.

WldUseMj ("If you had the opportunity in the future, would you use marijuana?"): 0 = Yes, 1 = No.

RestrMj ("If marijuana were legalized, should it be restricted to those 18 years of age or older?"): 0 = Yes, 1 = No.

LegalMj ("Do you feel that society should legalize marijuana at this time?"): 0 = No, 1 = Undecided, 2 = Yes.

q = 8

p = 6

Table 5.2

Canonical Analysis of Background Variables versus Marijuana Questions

	1	2	3	4[a]	5[a]	6[a]
i:						
R_i^2:	.3035	.1182	.0254	.0062	.0042	.0008
R_i:	.551	.344	.159	.079	.065	.028
Sex	−.188	.185	.719			
Age	−.309[b]	.473	−.322			
Class	.045	.616	.155			
Pannuinc	.085	−.078	−.385			
ReligAct	.623	.180	−.117			
YrPolAct	−.258	.031	.011			
AgrPVN	−.194	−.123	−.023			
AgrPSex	−.395	.002	−.504			
Nmarij	.295	1.815	−.581			
FstMarij	−.185	1.920	−.228			
NowUseMj	.061	−.508	−.662			
WldUseMj	−.244	−.209	−.157			
RestrMj	.067	−.147	.491			
LegalMj	.474	.270	.723			

[a] Coefficients have been omitted since R_i^2 is nonsignificant.

[b] Italicized coefficients are those which were emphasized in developing substantive interpretations of the canonical variates.

The first pair of canonical variates seem to be identifying a tendency for young, politically active but religiously inactive respondents who disagree with their parents on the topics of premarital sex and abortion to have tried marijuana at an early age, and to have used marijuana frequently in the past, to be in favor of legalizing its use, and to be willing to try marijuana again in the future should the opportunity present itself. Of course, this first canonical correlation is only .551, with the specified linear combination of the background variables accounting for only about 30% of the total variation in the specified combination of the responses to the marijuana questions. The second canonical R of .344 seems to suggest primarily that older, upperclass respondents have used marijuana extensively in the past but began this use late in their academic career. The third R_i of .159 indicates that young females from low-income families who disagree with their parents on the issues of premarital sex and abortion tend not to have used marijuana much in the past nor to be using it at present, but nevertheless to be more in favor of legalizing marijuana for everyone, 18 or not, than most other respondents.

It must be kept in mind that there is some loss in shared variance when we go from the canonical variates as actually computed by the canonical analysis to the "simplified" canonical variates implied by the above verbal descriptions. For instance, the correlation between

$$(-\text{Age} + \text{ReligAct} - \text{YrPolAct} - \text{AgrPSex})$$

and

$$(\text{Nmarij} - \text{FstMarij} + \text{LegalMj} - \text{WldUseMj})$$

is only .539 vs .551 for the first pair of canonical variates. Similarly, the second and third pairs of "simplified" canonical variates yield correlations of .285 (vs .344) and .148 (vs .159).

At any rate, the three sources of relationship between the two sets of variables uncovered by the canonical analysis seem to be tapping important trends which would have been difficult to uncover through examination of the individual pairwise correlations. The first canonical correlation, with its suggestion that "activist" students who have "tuned out" religion are especially likely to use marijuana, is particularly interesting in light of theories which predict that drug users should be primarily dropouts who have been discouraged by the difficulty of political reform and have turned their interests inward.