There are several possible strategies for analysis of repeated measures designs. Both univariate and multivariate solutions can be obtained. Selection of a strategy should be based on the appropriateness of the necessary assumptions as well as power considerations.

1.46 An Example

Data from a repeated measures design found in Winer (1971, p. 546) are shown in Table 1.46. They consist of accuracy scores obtained by adjusting three dials (DIAL) under two levels of background noise (NOISE) during three consecutive ten-minute periods (PERIOD). Each subject is observed nine times, once at each combination of period and dial type. PERIOD and DIAL are called within- subjects factors, while NOISE is called a between-subjects factor. If subject is considered a factor, then the subject factor is crossed with PERIOD and DIAL, but nested under NOISE level.

Table 1.46

Noise	Subject	Periods:	1			2			3		
		Dials:	1	2	3	1	2	3	1	2	3
1	1		45	53	60	40	52	57	28	37	46
	2		35	41	50	30	37	47	25	32	41
	3		60	65	75	58	54	70	40	47	50
2	4		50	48	61	25	34	51	16	23	35
	5		42	45	55	30	37	43	22	27	37
	6		36	60	77	10	19	37	11	19	16

1.47 Obtaining a Univariate Analysis the Hard Way

The univariate analysis of the repeated measures design displayed in Table 1.46 is obtained by treating subject as a random effect nested under the NOISE factor. The model is called a mixed-effects model, and the resulting analysis is a mixed-model analysis of the repeated measures design.

The technique described in Section 1.25 can be used to determine the appropriate error terms for testing the various effects. Table 1.47 summarizes the effects and corresponding error terms for this example.

Table 1.47

Effect	Error Term
NOISE	Subject within NOISE
PERIOD NOISE × PERIOD	PERIOD × Subject within NOISE
DIAL NOISE × DIAL	DIAL × Subject within NOISE
PERIOD × DIAL NOISE × PERIOD × DIAL	PERIOD × DIAL × SUBJECT within NOISE

Figure 1.47a shows an SPSS command file that can be used to perform a univariate analysis of the repeated measures design for the data in Table 1.46. The resulting ANOVA table is presented in Figure 1.47b. A somewhat complicated DESIGN specification is needed because of the multiple error terms in the model. In the next section, a much easier approach to the same problem is given.