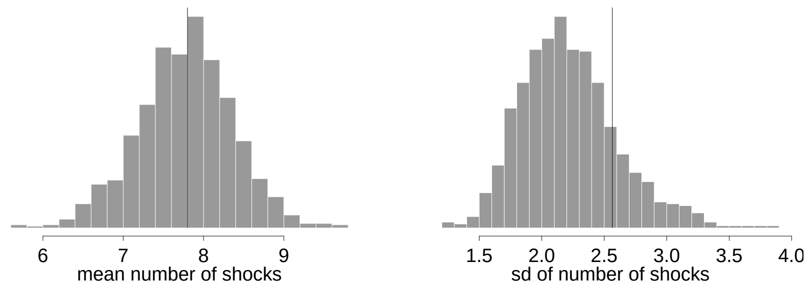


Figure 24.3 *Predictive checks for the (a) mean and (b) standard deviation of the number of shocks among the 30 dogs. The vertical bars indicate the observed values of the test statistics $T(y)$, and the histograms display $T(y^{\text{rep}})$ from 1000 draws of $y^{\text{rep}}$ under the logistic model.*

Thus, these two aspects of the data are fit reasonably well; however, the systematic problem we have found in the early trials indicates a problem with the model.

### *Fitting and checking a logarithmic regression model*

We now move to a more reasonable logarithmic regression model for the same data (which was in fact fit by the psychologists who performed the early data analyses):

$$\Pr(y_{jt} = 1) = \exp(\beta_1 X_{1jt} + \beta_2 X_{2jt}), \tag{24.4}$$

with $X_{1jt}$ and $X_{2jt}$ the number of previous avoidances and shocks, respectively, as defined in (24.2). Unlike the logistic model (24.1), this model has no constant term because the probability of shock is fixed at 1 at the beginning of the experiment. In addition, $\beta_1$ and $\beta_2$ are restricted to be negative.

The Bugs model is similar to the logistic regression on page 517 except with the `logit(p[j,t])` line changed to:

```
log(p[j,t]) <- b.1*n.avoid[j,t] + b.2*n.shock[j,t]
```
Bugs code

The log model omits the intercept term, $b_0$, so that the probability of a shock is 1 for the first trial. In addition, the coefficients $\beta_1, \beta_2$ must be constrained to be negative, so we give them the following noninformative distributions:

```
b.1 ~ dunif (-100, 0)
b.2 ~ dunif (-100, 0)
```
Bugs code

The median estimates of the parameters $\beta_1$ and $\beta_2$ in the logarithmic model are $-0.24$ and $-0.08$, with standard errors of 0.02 and 0.01, respectively. The coefficient for avoidances, $\beta_1$, is estimated to be more negative than $\beta_2$, indicating that avoidances have a larger effect than shocks in reducing the probability of future shocks. Transforming back to the probability scale, the median estimates for $(e^{\beta_1}, e^{\beta_2})$ are $(0.79, 0.92)$, indicating that an avoidance or a shock multiplies the predicted probability of shock by an estimated factor of 0.79 or 0.92, respectively.

Having fit this improved model, we check its fit using predictive replications, which we simulate from the model as described earlier in this section (except using the logarithmic rather than the logistic link). A single random draw from the predictive distribution of 30 new dogs is displayed on the right side of Figure 24.1. A check of the average number of avoidances over time—Figure 24.4, replicating Figure 24.2—shows no apparent discrepancies with this aspect of the data: the logarithmic link has fixed the problem with the early trials.