M-H for parameters w/ constraints:

Example: $y_i \sim \text{Bern}(\theta)$, $i = 1, \ldots, n$
$\theta \sim \text{Beta}(\alpha, \beta)$, $0 < \theta < 1$

$[\theta | y] \propto [y | \theta][\theta]$
$= \text{Beta}\left(\sum_i y_i + \alpha, \sum_i (1 - y_i) + \beta\right)$

Suppose we want/need MCMC w/ M-H updates:
Proposals:
1.) prior: $\theta^* \sim [\theta]_* = [\theta]$

2.) RW: $\theta^* \sim [\theta | \theta^{(k-1)}]_*$ and reject
if $\theta^* < 0$ or $\theta^* > 1$.
If $0 < \theta^* < 1$, use
$mh = \dfrac{[y | \theta^{(*)}][\theta^{(*)}]}{[y | \theta^{(k-1)}][\theta^{(k-1)}]}$

where $[\theta | \theta^{(k-1)}]_* = N(\theta^{(k-1)}, \sigma^2_{tune})$

3.) TN RW: $\theta^* \sim [\theta | \theta^{(k-1)}] = TN(\theta^{(k-1)}, \sigma^2_{tune})\big|_0^1$

$mh = \dfrac{[y | \theta^{(*)}][\theta^{(*)}][\theta^{(k-1)} | \theta^{(*)}]}{[y | \theta^{(k-1)}][\theta^{(k-1)}][\theta^{(*)} | \theta^{(k-1)}]}$

Other models:

1.) $y_i \sim N(\mu, \sigma^2)$
$\mu \sim N(\mu_0, \sigma_0^2)$
$\sigma^2 \sim \text{Gamma}(a, b)$

2.) $y_i \sim \text{Beta}(\alpha, \beta)$
$\alpha \sim \text{Gamma}(a_\alpha, b_\alpha)$
$\beta \sim \text{Gamma}(a_\beta, b_\beta)$