$\cancel{\mu(f)}$ $\mu_y(f) = \cancel{\int f(x) p(y|}$

$$\int f(x)\, p(x|y)\, dx \quad = \mathbb{E}[f(X)|Y=y]$$

$$\mu(1_A) = \int_A p(x|y)\, dx.$$

$$\omega \mapsto \int f(x)\, p(x|y(\omega))$$

$$= \int f(X)\, p(X|Y)\, dx = \mathbb{E}[f(X)|Y]$$

Yes see p14 of Alan Sch[illegible]notes

$$\mathbb{E}[f(X)|Y] = \mu_Y(f)$$

So $\mathbb{E}[f(X)\,|\,Y](\omega) = \mathbb{E}[f(X)\,|\,\cancel{Y(\omega)}\ Y = Y(\omega)]$

$d(Y)$

$\omega \mapsto d(Y(\omega))$

as $d(Y)$ is the r.v. $d(Y): \Omega \to \mathbb{R}$

$\omega \mapsto d(Y(\omega))$