The Substitution Law does not work for interactive variables.

(a) Show an example of the failure of the law.
§ Let \( x \) be an interactive variable, and let \( t \) be time. Suppose an assignment takes time 1.

\[
x := 3. \quad x' = x \land t' = t \quad \Rightarrow \quad x' = 3 \land t' = t + 1
\]

whereas the Substitution Law would say \( x' = 3 \land t' = t \). The problem is that assignment to an interactive variable has to take time.

(b) Develop a new Substitution Law for interactive variables.
§ Let \( a \) be the time for the assignment. Let \( y \) be any other interactive variable.

\[
x := e. \quad P
\]

\[
x(t + a) = e \land (\forall t'': \ t \leq t'' \leq t + a \Rightarrow y'' = y) \land (\text{substitute } t + a \text{ for } t \text{ in } P)
\]