Session Types and Cake

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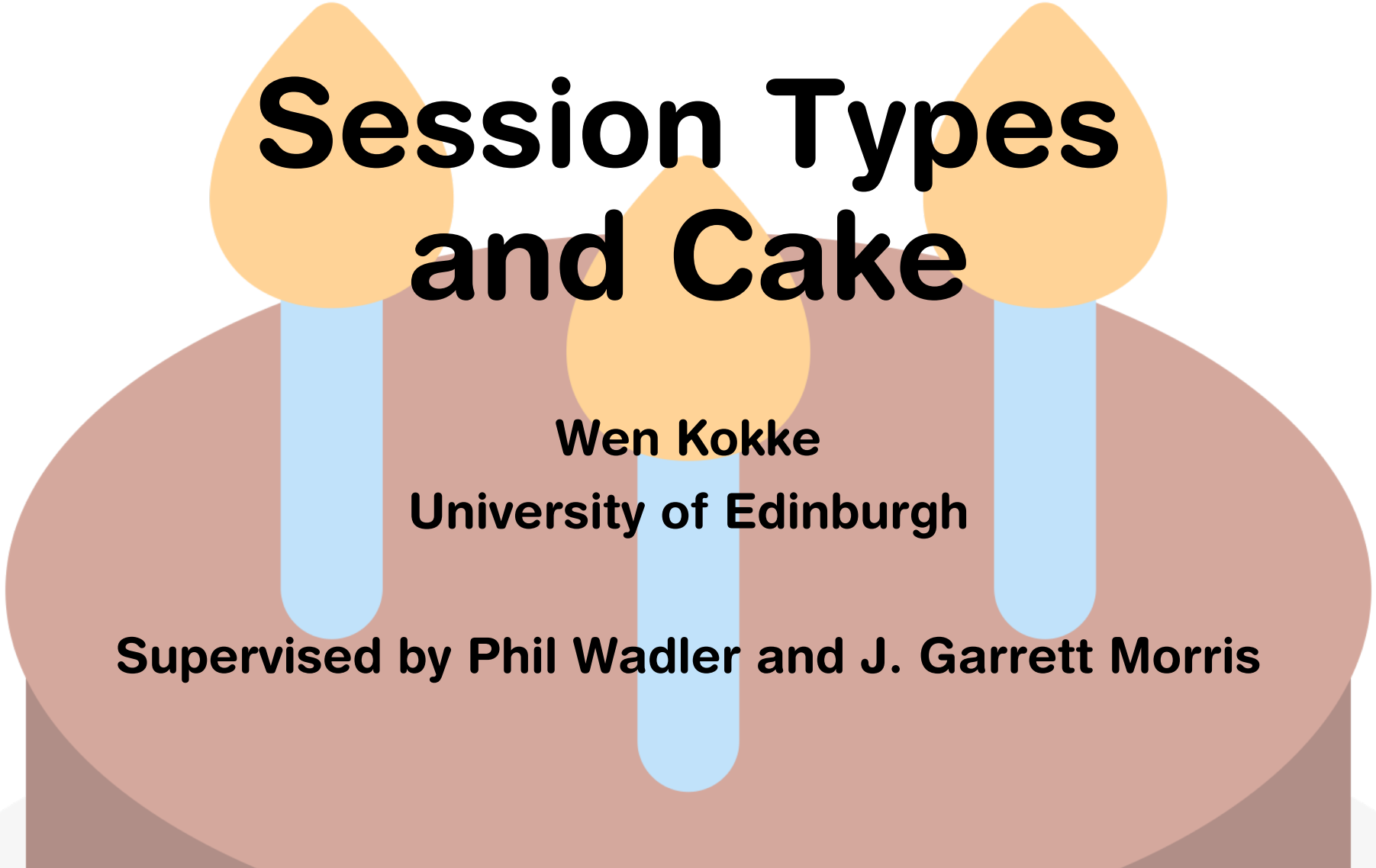
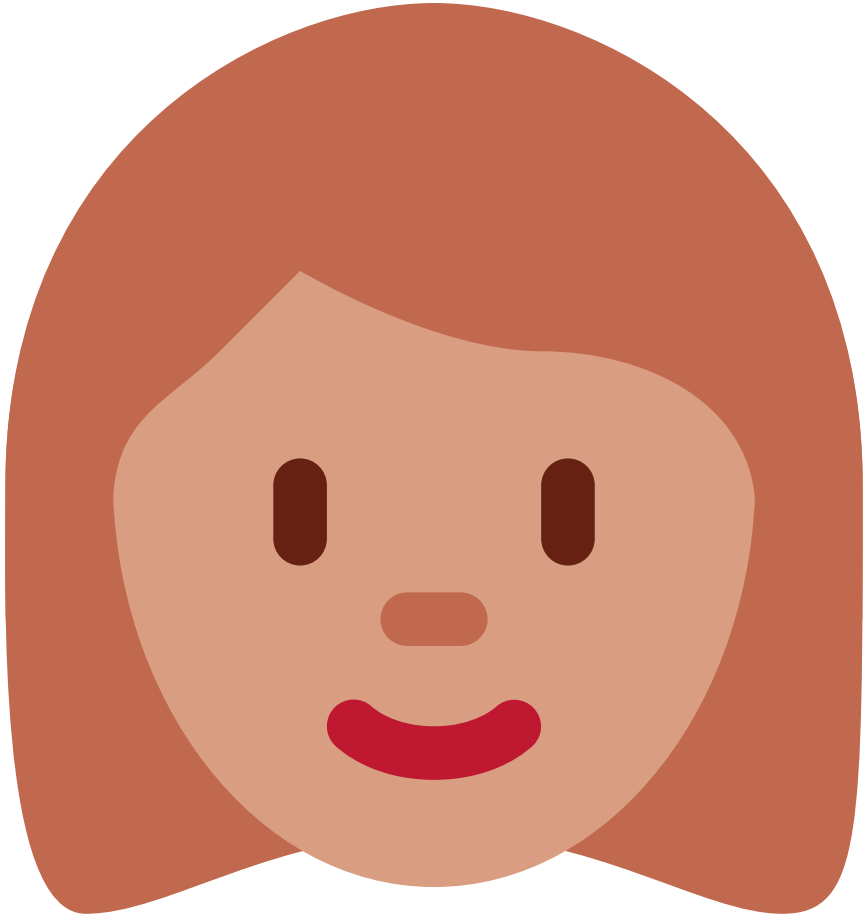
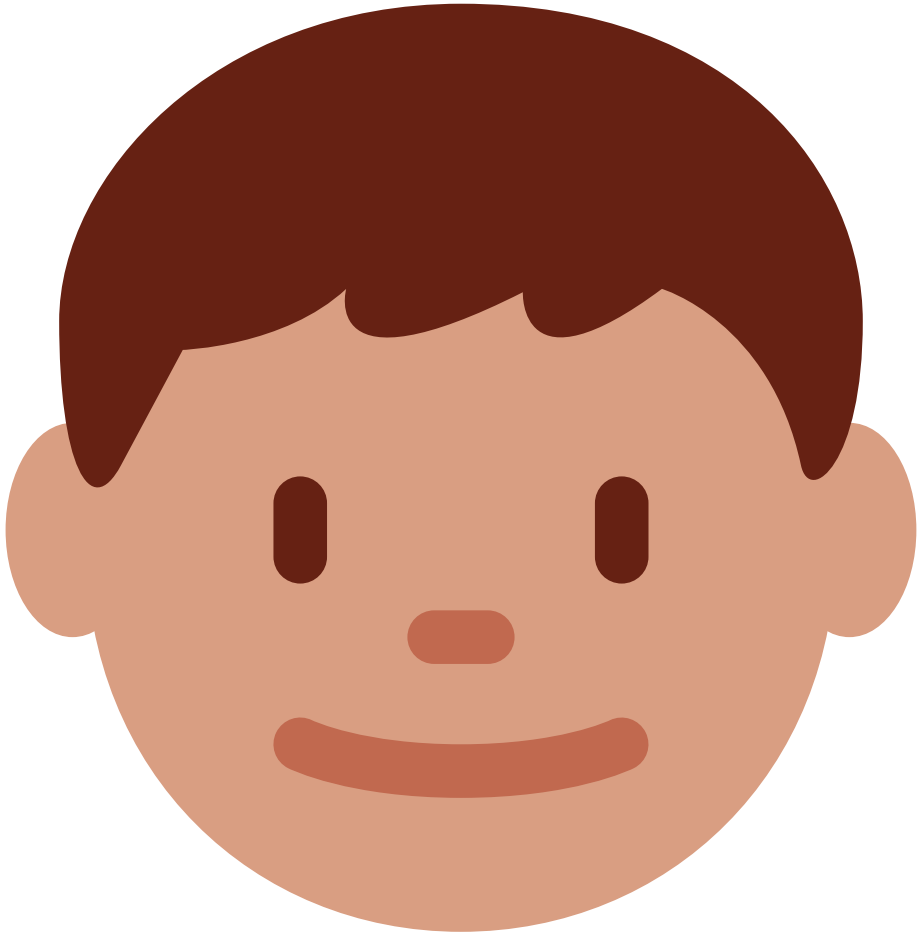


First, a story.



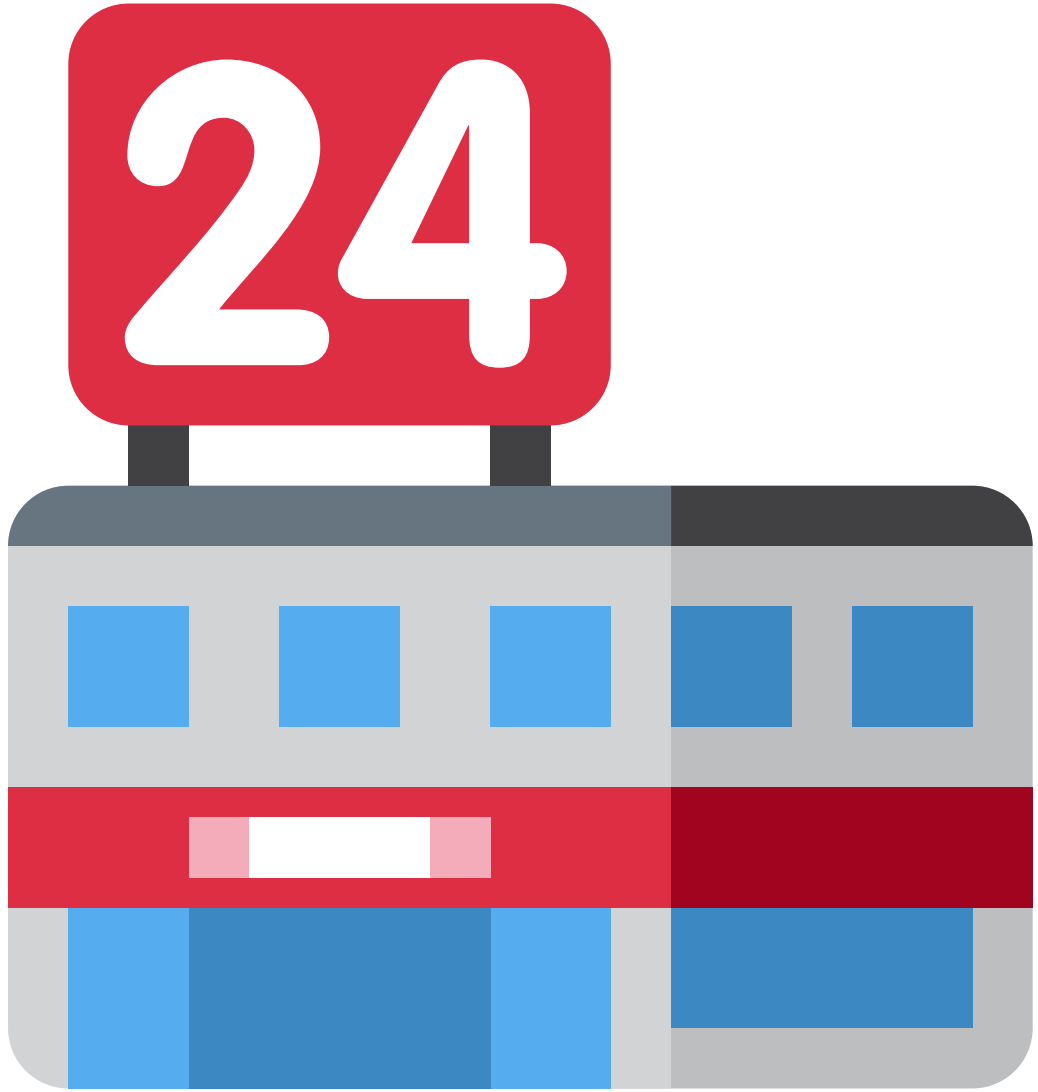
This is Mary.
She loves cake.



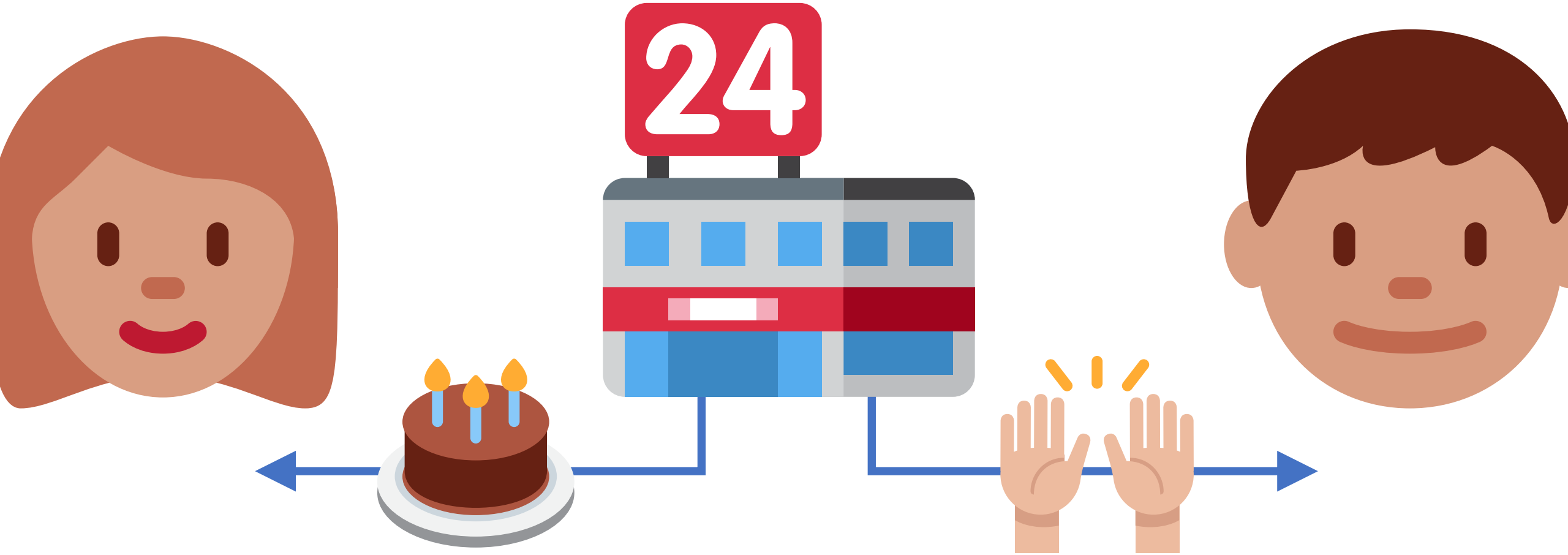
This is John.
He loves cake too.

This is a store.
It sells cake.

There is only
one cake left.

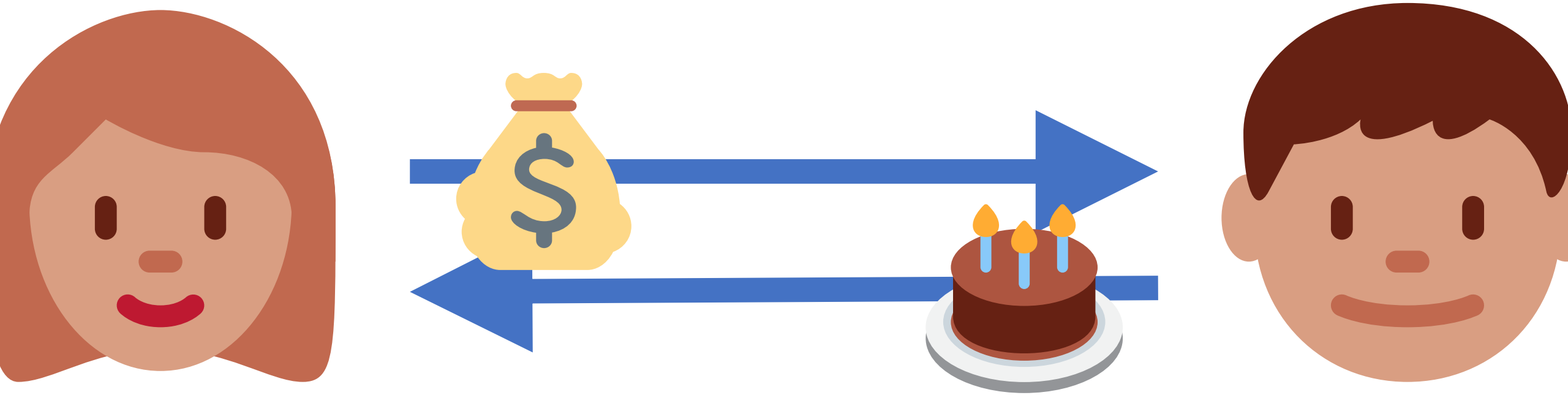


Mary and John have to *race*.
That's ok. The store doesn't mind.



So…
Races are good sometimes!

And deadlocks are bad.
I’m sure we all know.



This is Classical Processes.

$$\frac{}{x{\leftrightarrow}y \vdash x : A, y : A^{\perp}}\ \textsc{Ax} \qquad \frac{P \vdash \Gamma, x : A \qquad Q \vdash \Delta, x : A^{\perp}}{\nu x.(P \mid Q) \vdash \Gamma, \Delta}\ \textsc{Cut}$$

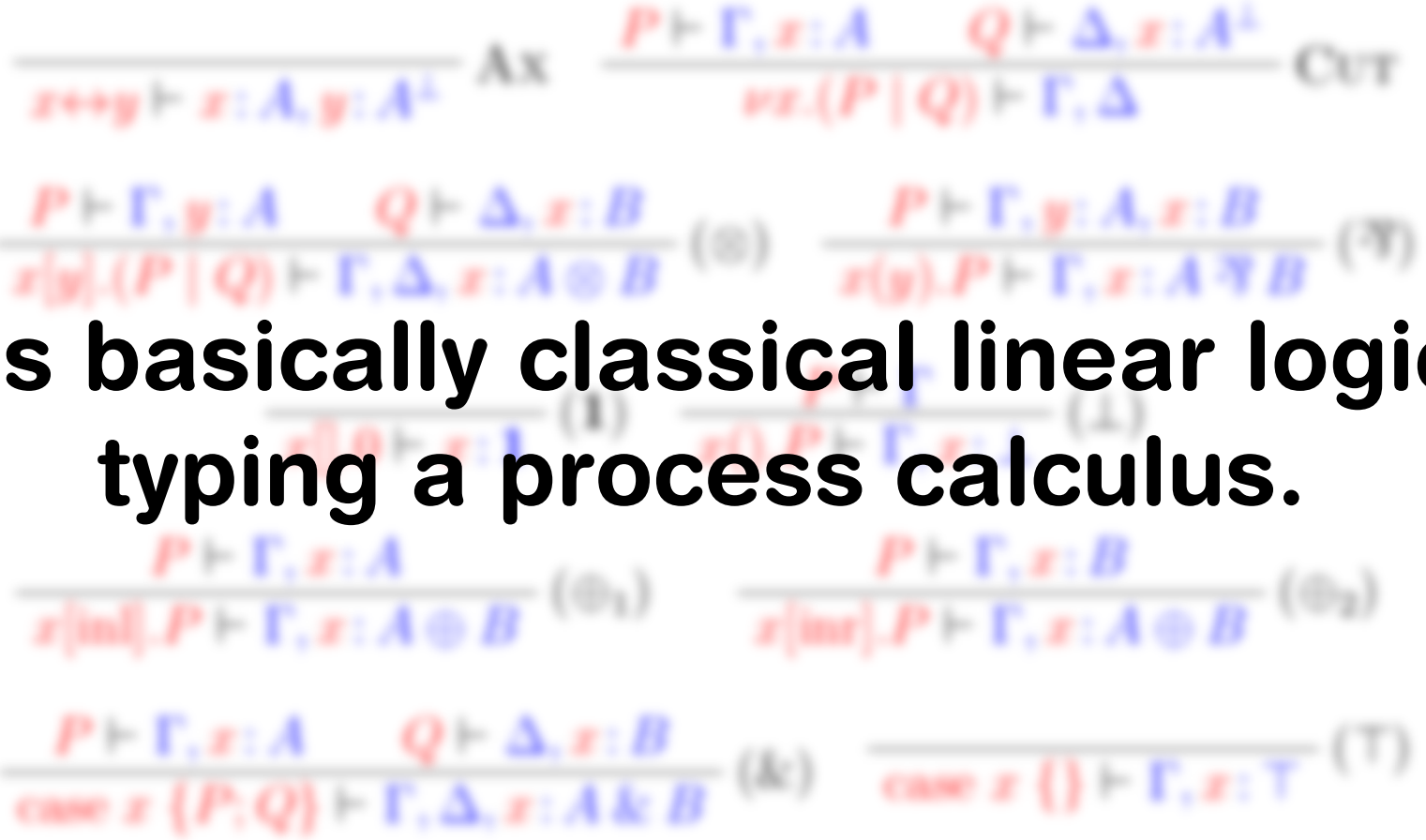
$$\frac{P \vdash \Gamma, y : A \qquad Q \vdash \Delta, x : B}{x[y].(P \mid Q) \vdash \Gamma, \Delta, x : A \otimes B}\ (\otimes) \qquad \frac{P \vdash \Gamma, y : A, x : B}{x(y).P \vdash \Gamma, x : A \parr B}\ (\parr)$$

$$\frac{}{x[].0 \vdash x : \mathbf{1}}\ (\mathbf{1}) \qquad \frac{P \vdash \Gamma}{x().P \vdash \Gamma, x : \bot}\ (\bot)$$

$$\frac{P \vdash \Gamma, x : A}{x[\mathrm{inl}].P \vdash \Gamma, x : A \oplus B}\ (\oplus_1) \qquad \frac{P \vdash \Gamma, x : B}{x[\mathrm{inr}].P \vdash \Gamma, x : A \oplus B}\ (\oplus_2)$$

$$\frac{P \vdash \Gamma, x : A \qquad Q \vdash \Delta, x : B}{\mathrm{case}\ x\ \{P; Q\} \vdash \Gamma, \Delta, x : A \,\&\, B}\ (\&) \qquad \frac{}{\mathrm{case}\ x\ \{\} \vdash \Gamma, x : \top}\ (\top)$$

This is Classical Processes.



It's basically classical linear logic,
typing a process calculus.

This is what I've added.

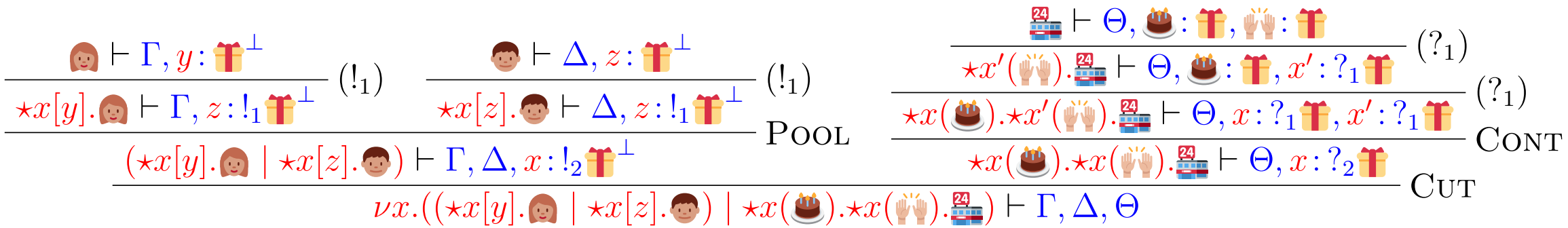
$$A, B, C := \ldots \mid !_n A \quad \text{pool of } n \text{ clients} \mid ?_n A \quad n \text{ server interactions}$$

$$P, Q, R := \ldots \mid \star x[y].P \quad \text{client creation} \mid \star x(y).P \quad \text{server interaction} \mid (P \mid Q) \quad \text{parallel composition of clients}$$

$$\frac{P \vdash \Gamma, y : A}{\star x[y].P \vdash \Gamma, x : !_1 A}\ (!_1) \qquad \frac{P \vdash \Gamma, y : A}{\star x(y).P \vdash \Gamma, x : ?_1 A}\ (?_1)$$

$$\frac{P \vdash \Gamma, x : !_m A \qquad Q \vdash \Delta, x : !_n A}{(P \mid Q) \vdash \Gamma, \Delta, x : !_{m+n} A}\ \textsc{Pool} \qquad \frac{P \vdash \Gamma, x : ?_m A, y : ?_n A}{P\{x/y\} \vdash \Gamma, x : ?_{m+n} A}\ \textsc{Cont}$$

This is our example race.

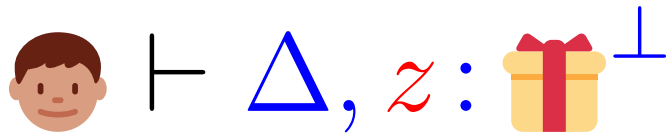


(🎁: Could be cake, could be disappointing.)

This is our example race.

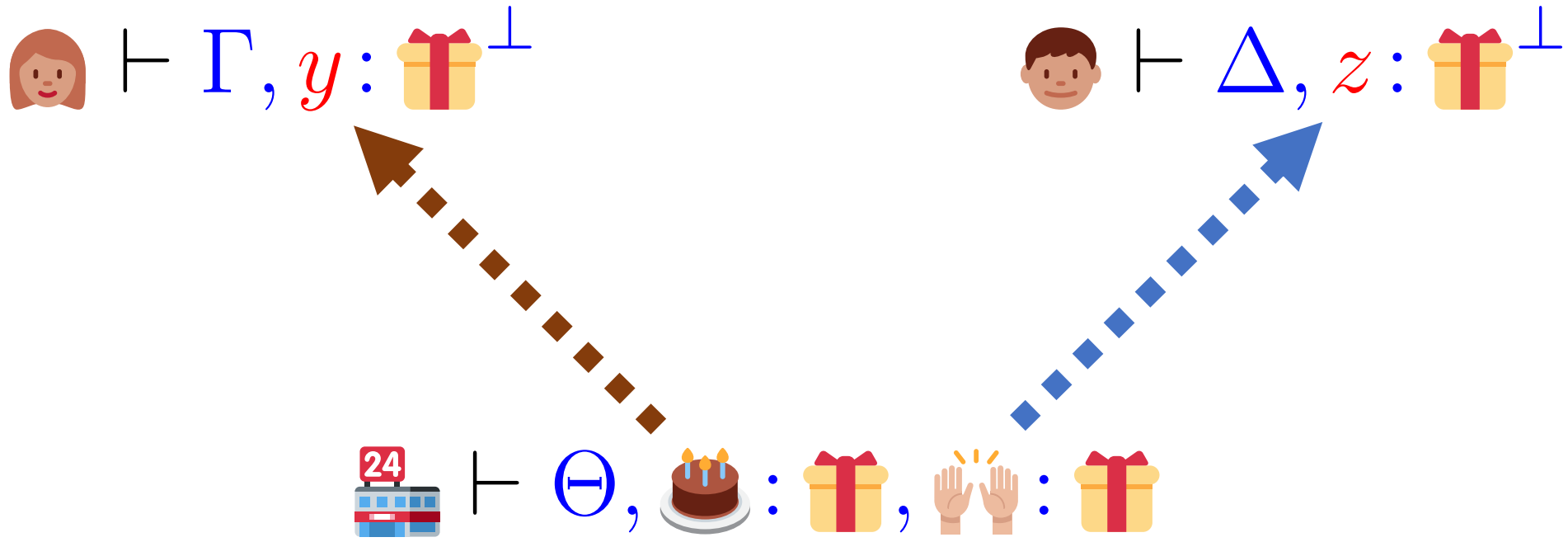
(🎁: Could be cake, could be disappointing.)

Who gets the cake?



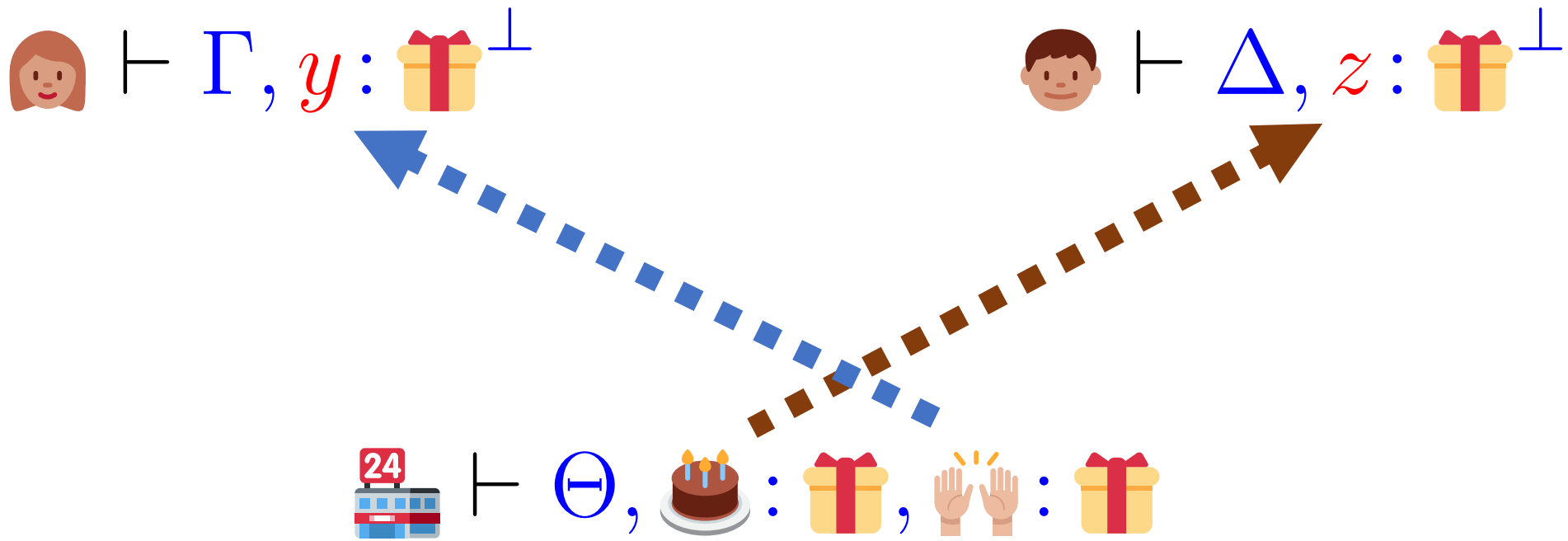
(🎁: Could be cake, could be disappointing.)

Mary gets the cake.



(🎁: Could be cake, could be disappointing.)

John gets the cake.



(🎁: Could be cake, could be disappointing.)

And so we had races,
but no deadlocks.

The End.

Thanks!

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