List of known errata in the master thesis 'Towards a Directed Homotopy Type Theory based on 4 Kinds of Variance'

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Most of these errata are (possibly confusing) typos. Please see errata containing **boldface text** for the more serious ones.

p7 Above equation (1.6): 'There is a generalization of dependent ~~types~~ functions.'

p23 Above, it says: 'However, composition $f \circ \Box$ with a v-variant function f, ~~reverts morphisms v-variantly~~'. Should be: 'However, composition $f \circ \Box$ with a v-variant function f, is v-variant.'

p26 Equation (2.58): the assumption $\Gamma \vdash A :^{-} \mathcal{U}_k$ should be $\Gamma \vdash A :^{u} \mathcal{U}_k$.

p28 Equation (2.68): a '+' goes on the arrow.

p30 This is the first time an induction principle is mentioned, despite what is being insinuated by the use of the word 'again' below equation (2.76).

p31 Guideline 2.7.2, third bullet: not $C[t]$ but $C[e]$.

p51 Equation (2.171): The invariance mark $\times$ should be an isovariance mark $=$:

$$\dots \left(\prod_{a:A}^{=} C(\mathsf{gather}\, a) \right) \dots \tag{1}$$

p54 Equation (2.186), 2nd line: not $B[e]$ but $B[\mathsf{prl}\, e]$.

p56 Equation (2.198): idem.

p69 Equation (2.253): The LHS $(g \circ f)(a, a, \mathsf{refl}\, a)$ is a more obscure way of writing the LHS of equation (2.252) $(g(a,a) \circ f(a,a))(\mathsf{refl}\, a)$, that adds nothing to the exposition.

p70 Definition 2.16.1: The path type symbol $=$ is used repeatedly instead of the morphism type symbol $\rightsquigarrow$. Just below the definition box, 'The covariance of the ~~identity~~ type family in A' should become 'the morphism type family'.

p73 Equation (2.270): Replace the variance annotation 4 (denoting variance irrelevance) with $+$. Replace $a =_A b$ with $a \rightsquigarrow_A b$.

p73 Equation (2.272): idem equation (2.253).

p73 Equation (2.273): Replace 4 with $+$.

p75 Equation (2.280): Not a definitional equality ($\equiv$), but a propositional one ($=$), see the HoTTbook.

p77 End of 2nd paragraph: 'we will be able to prove that every covariant function preserves ~~equalities~~ covariantly.' This is true, but what I intended to say was that every covariant function preserves morphisms covariantly.

p84 Equation (3.20): Not $f(p)$ but $f(x)$.

p85 Above equation (3.27): replace 'morphism induction' with 'path induction'.

p86 Equation (3.30): Remove one '(f)'.

p87 Below equation (3.37): The - is interpunction, not mathematical. 'Al' should be 'all'.

p88 Proof of Lemma 3.3.5: The identity equivalence is $(\mathrm{id}A, (\mathrm{id}A, \mathsf{refl}\,\mathrm{id}A), (\mathrm{id}A, \mathsf{refl}\,\mathrm{id}A))$, not $(\mathrm{id}A, \mathrm{id}A, \mathsf{refl}\,\mathrm{id}A, \mathsf{refl}\,\mathrm{id}A)$.

p89 Equation (3.41): Below the $\sum$'s, replace function arrows $\to$ with morphism arrows $\rightsquigarrow$.

p90 Proof of Lemma 3.3.12: idem p88.

p91 Below proof of Theorem 3.3.14: 'Since at this point, the theory contains no rules for creating ~~covariant~~ isovariant functions ...'

p95 Lemma 3.4.5: Remove the argument q.

p95 Section 3.4.2: The variance of heterogeneous types is insufficiently justified and probably incorrect. Take this entire section with a grain of salt.

p101 Lemma 3.4.12: In the reverse arrow part of the proof, we apply morphism induction, but the variance conditions are not fulfilled. **The proof is incorrect, leaving the lemma a conjecture!**

p102 Lemma 3.4.13: Same problem!

p104 Lemma 3.4.14: Same problem! (And some typos on top.)

p115 Lemma 3.6.5: '... $N :^{=} f \succ g$ be a ~~homotopy~~ natural transformation.' In the proof, replace $f(x) = g(x)$ with $f(x) \rightsquigarrow g(x)$.

p117 Proof of Lemma 3.7.1, second line: $x \overset{\times}{\mapsto}{}' C(\mathsf{unstrip}\, x')$ should be $x' \overset{\times}{\mapsto} C(\mathsf{unstrip}\, x')$.

p120 Equation (3.128): Not P, but C.

p122 Equations (3.138) and (3.140): Replace the central $=$ symbol with $\overset{+}{\to}$.

p123 Equation (3.143): Not $L(Xf \overset{=}{\mapsto} r \overset{=}{\mapsto} (f)^{=}(p))$, but $L(X \overset{=}{\mapsto} f \overset{=}{\mapsto} r(f)^{=}(p))$.

p124 Above equation (3.147): The type family $Z \overset{\times}{\mapsto} \left(\prod^{=}_{f:A\overset{=}{\to}Z} f(a) =_Z f(b)\right)$. The codomain of the argument f is Z, not X. Better even would be to write $Z \overset{\times}{\mapsto} \left(\prod^{=}_{g:A\overset{=}{\to}Z} g(a) =_Z g(b)\right)$, avoiding name conflicts.

p125 Equation (3.151): Missing primes: $(a =_A a') \overset{+}{\to} (b =_B b') \overset{+}{\to} \ldots$

p128 First line: 'However, the fact that $\sum^{=}_{a:A} B(a)$' is the injective limit, is likely more interesting ...

p129 2nd line below the subtitle, a variance annotation is missing. $f : \prod^{=}_{a:A} B(a)$.

p132 Lemma 3.8.23.2: Not 'For every path $\varphi : A = B$', but 'For every morphism $\varphi : A \rightsquigarrow B$'.

p133 Definition 3.9.2: The precategory is called A, not C.

p135 Equation (3.175): $\mathsf{catTransport}_{a,b}$, not $\mathsf{catTransport}_{A,B}$.