# The Gassner calculus planarity condition for 2-tangles

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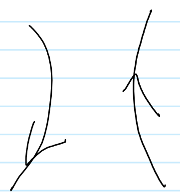
$$\left(\begin{array}{c|cc} \nu\omega & c & S \\ \hline c & \beta+\alpha\delta/\nu & \theta+\alpha\epsilon/\nu \\ S & \psi+\delta\phi/\nu & \Xi+\epsilon\phi/\nu \end{array}\right)_{T_a,T_b\to T_c} \xleftarrow[\nu:=1-\gamma]{m_c^{ba}} \begin{array}{c|ccc} \omega & a & b & S \\ \hline a & \alpha & \beta & \theta \\ b & \gamma & \delta & \epsilon \\ S & \phi & \psi & \Xi \end{array} \xrightarrow[\mu:=1-\beta]{m_c^{ab}} \left(\begin{array}{c|cc} \mu\omega & c & S \\ \hline c & \gamma+\alpha\delta/\mu & \epsilon+\delta\theta/\mu \\ S & \phi+\alpha\psi/\mu & \Xi+\theta\psi/\mu \end{array}\right)_{T_a,T_b\to T_c}$$

$$\Downarrow$$

$$\begin{array}{c|c} (1-\gamma)w & \\ \hline & \beta+\frac{\alpha\delta}{1-\gamma} \end{array} \longleftarrow \begin{array}{c|cc} w & & \\ \hline & \alpha & \beta \\ & \gamma & \delta \end{array} \longrightarrow \begin{array}{c|c} (1-\beta)w & \\ \hline & \gamma+\alpha\delta/1-\beta \end{array}$$



$\Rightarrow (1-\gamma)w=(1-\beta)\gamma \quad \Rightarrow \beta=\gamma$

$\phantom{\Rightarrow (1-\gamma)w=(1-\beta)\gamma} \quad \Rightarrow \alpha=\delta$

$\Rightarrow$ mutation invariance!

after identifying variables.

But I have to be able to deduce $m_c^{ab}=m_c^{ba}$ in a direct way.....

..... follows from the under-slide relation; see MutationProperty.nb.

Non-splicing mutations: