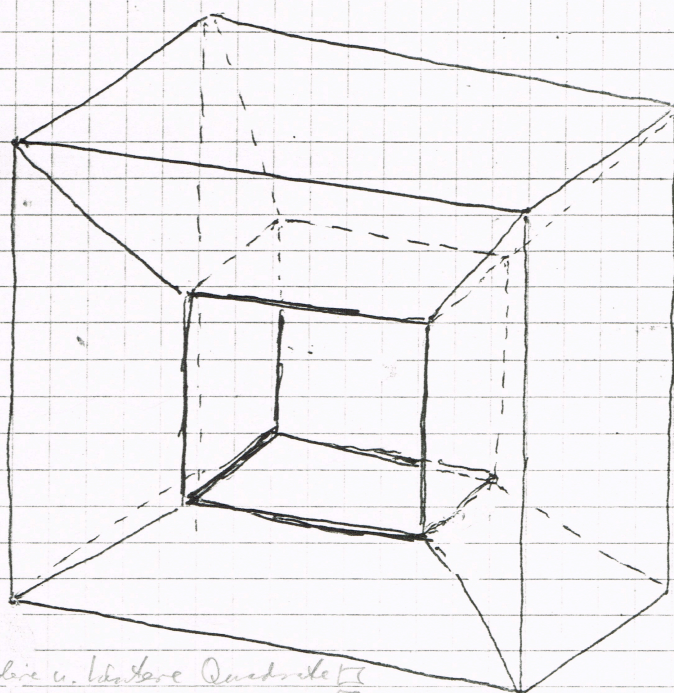
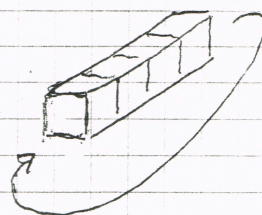
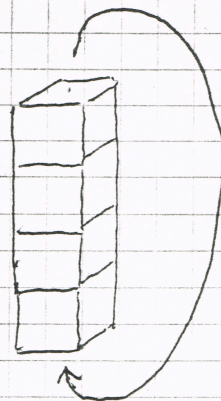


Das Bild enthält a. bei Zeichnung d. → Boolean-Verbandes mit 4 Variablen (Elementen)



Weglassen: Vorder- u. hintere Quadrate
des "äußeren u. inneren Würfels", sowie die inneren
Beziehungen zw. den Pyramidenhöfen $\Rightarrow$ Torus



A four-dimensional cube has

16 •

32 |

24 □

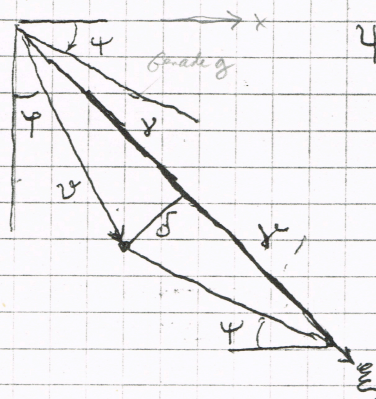
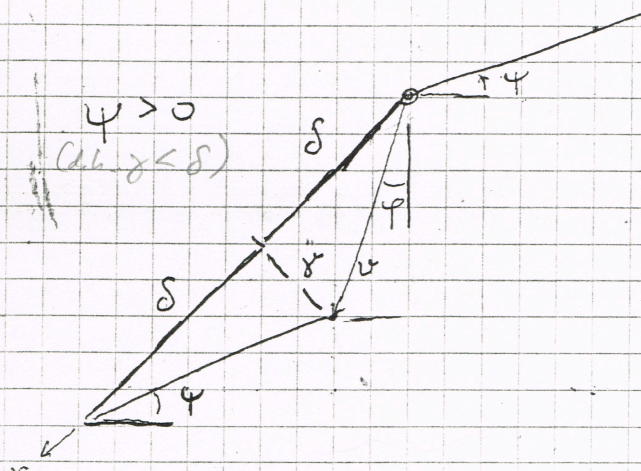
8  = 2 toruses of 4  each.

Thm. On a 4cube there is a 2surface consisting of 16 □ which is the common surface of 2 3dim. toruses.

$\therefore$ In 4space, clock model and track model of a cycloid are identical

Retardation, Slowness w
in balanced Cycloid:

(Vor: $\varphi = -\varphi$)



$\psi < 0$ (d.h. $\gamma > \delta$)

V: Betrag sagt: wie schnell muß man s. bewegen um die Verteilung v. "0" u. "1" in ihrer natürl. Dichte zu sehen

$$\# \text{ max. steps} = 2 \text{Max}(\gamma, \delta)$$

$$\# \text{ steps per local basic circuit: } \gamma + \delta$$

$$\text{Def.: } |w| := \frac{2 \text{Max}(\gamma, \delta) - (\gamma + \delta)}{\gamma + \delta} = \frac{\# \text{ additional steps}}{\# \text{ steps on l.b.c.}} \quad \text{local basic circuit}$$

$$\text{Def. } \text{sgn } w := \text{sgn}(\gamma - \delta) = \text{sgn } v$$

$$\text{Thm.: } w = \frac{\gamma - \delta}{\gamma + \delta}$$

bemerkte
Vor: $\varphi = -\varphi$

$$-1 < w < +1$$

$$v = \frac{\alpha - \beta}{\alpha + \beta}$$

$$-1 < v < +1$$

$$\frac{\alpha}{\beta} = \frac{\gamma}{\delta} \Rightarrow v = w$$

Physical meaning: $v = c^2 \cdot w$
(metrische Betrachtung)

$$v_{\text{Max}} = c \left[\frac{m}{s} \right] = 3 \cdot 10^8 \frac{m}{s}$$

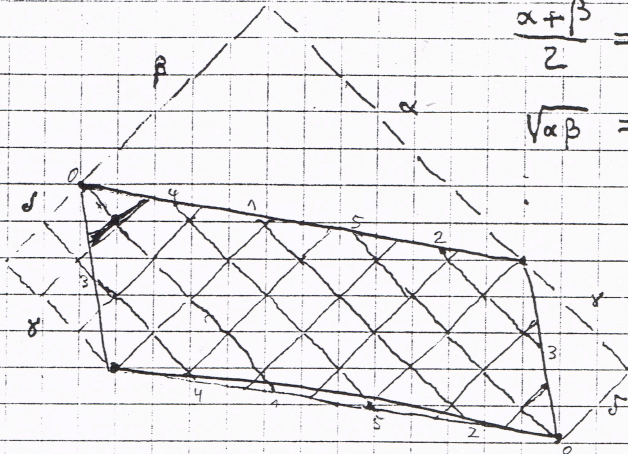
$$w_{\text{Max}} = \frac{1}{c} \left[\frac{s}{m} \right] = 3.3 \cdot 10^{-9} \frac{s}{m} = 3.3 \frac{ns}{m}$$

p : Anzahl der Tokens des Systems ($\alpha + \beta$)
Anzahl der Transitionen, die aktiviert sind

$$\frac{\alpha + \beta}{2} =: \text{degree of concurrency}$$

$$\sqrt{\alpha \beta} =: \text{rest-unit of unit-cy.}$$

Ruhe-Einheit P des Einheitszuges



$$(\alpha \beta \gamma \delta) = (7, 5, 3, 2)$$

$$v = \frac{3-2}{3+2} = \frac{1}{5}$$

$$w = \frac{7-5}{7+5} = \frac{2}{12} = \frac{1}{6}$$

$$A = 14 + 15 = 29$$

$\alpha = \#$ backflow tokens

$\beta = \#$ forw. flow tokens

$\gamma = \#$ backward lines = reservation # for forw. tokens

$\delta = \#$ forward lines = reservation # for backw. tokens

$$A = \alpha \delta + \beta \gamma = \# \text{ transitions} = \frac{1}{2} \# \text{ state els. !}$$

$$= \# \text{ forw. st. els.} = \# \text{ backw. st. els.}$$

Ans. der tokens
sollten nicht
zu klein sein
sonst P degree
of concurrency
 $(\alpha + \beta)/2$ ist die
Anzahl der concurrent
Anzahl der concurrent
Anzahl der concurrent

$$\frac{A}{\delta} = \frac{\# \text{ forw. sections}}{\# \text{ forw. lines}} = \alpha + \beta \frac{\gamma}{\delta} = \text{for Kellmid: } \alpha + k \gamma = 2\alpha =: l$$

$$\frac{A}{\gamma} = \frac{\# \text{ backw. sections}}{\# \text{ backw. lines}} = \frac{\alpha \delta}{\gamma} + \beta = k \delta + \beta = 2\beta$$

$$\frac{A}{\beta} = \frac{\# \text{ forw. sections}}{\# \text{ forw. tokens}} = \frac{\alpha \delta}{\beta} + \gamma = \frac{\alpha}{k} + \gamma = 2\gamma$$

$$\frac{A}{\alpha} = \frac{\# \text{ backw. sections}}{\# \text{ backw. tokens}} = \delta + \frac{\beta \gamma}{\alpha} = \delta + \frac{\beta}{k} = 2\delta$$

$$A = 2k\gamma\delta$$

$$T := \# \text{ trains} = T \cdot K, \quad K = \frac{\alpha}{\gamma} = \frac{\beta}{\delta}$$

$$\# \text{ tracks} := T, \quad 1 \leq T \leq \delta$$

$$\alpha = k\gamma$$

$$\beta = k\delta$$

$$v = w = \frac{\alpha - \beta}{\alpha + \beta} = \frac{\gamma - \delta}{\gamma + \delta}$$

$$l := \text{length of track} = 2\alpha \text{ sections}$$

$$\text{length of signal line} = 2\beta \text{ sections}$$

$$d := \# \text{ empty segm betw trains} = \gamma - 1$$

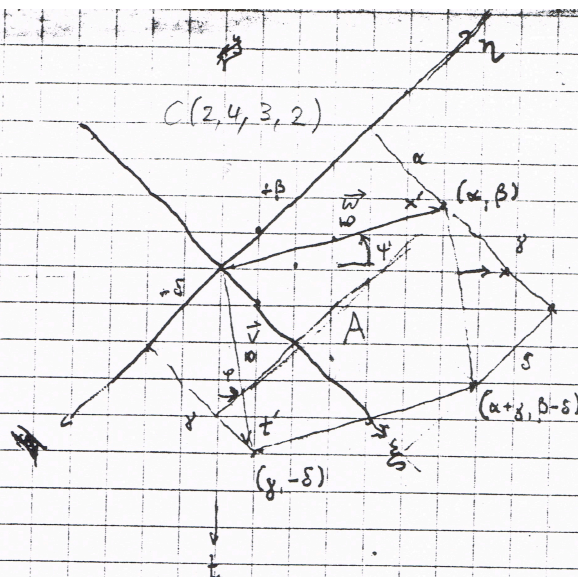
$$\text{given } l, \gamma, T, \delta: \alpha = \frac{l}{2}, k = \frac{\gamma}{T}$$

$$\gamma = \frac{l}{2k} = \frac{Tl}{2\alpha}$$

$$\beta = k\delta = \frac{\gamma\delta}{T}$$

$$\alpha \beta \gamma \delta \in \{1, 2, 3, \dots\}$$

$$v = w \cdot c^2$$



$\vec{v} \cdot \vec{w}$ hier
vergeben

$$\xi = \frac{1}{2}(x+t)$$

$$\eta = \frac{1}{2}(x-t)$$

$$x = \xi + \eta$$

$$t = \xi - \eta$$

$$A = (\alpha + \gamma)(\beta + \delta) - \alpha\beta - \gamma\delta$$

$$v = \tan \varphi = \frac{\gamma - \delta}{\gamma + \delta}$$

$$A = \alpha\delta + \beta\gamma$$

jeder Zykloide kann d.
geeignete Abbildung der An-
ordnung zu einer
ausgewogenen gemacht
werden.

$$w = -\tan \psi = \frac{\alpha - \beta}{\alpha + \beta}$$

$$-\frac{\pi}{2} < \varphi, \psi < +\frac{\pi}{2}$$

$$(\lambda) \quad \xi = \alpha x + \gamma t$$

$$(\mu) \quad \eta = \beta x - \delta t$$

Parallelogramm v. balanced Zykloiden:
aus den Ebenenbeschreibungen der für
keine Möbiustransformationen sind
aus den Transformationen (Längen) der
Richtungen auch nicht

(ausgewogen)

balanced $\Leftrightarrow v = w \Leftrightarrow \alpha\delta = \beta\gamma \Leftrightarrow \frac{\alpha}{\beta} = \frac{\gamma}{\delta}$ (Fläche)

(hier: $v = w$ u. Flächenschiefe ausgewogen: v. einem vollen der Schmelzpunkt
steht man genau so viel wie von einem benachbarten)

$$\xi\text{-Diag} \Leftrightarrow \beta = \delta \Leftrightarrow \eta(w+w) = 0$$

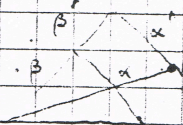
$$\text{Unit} \Leftrightarrow \alpha = \gamma \wedge \beta = \delta$$

$$\eta\text{-Diag} \Leftrightarrow \alpha = \gamma$$

$$K\text{-Unit} : \alpha = k\gamma \wedge \beta = k\delta \text{ räuml. Vervielf.}$$

$$Kt\text{-Unit} : \gamma = k\alpha \wedge \delta = k\beta \text{ zeitl. Vervielf.}$$

occurrence graph
unendl. $\rightarrow$ Semizykloide



$$\text{Let } \alpha = \gamma, \beta = \delta$$

$$\alpha' = \gamma', \beta' = \delta'$$

$$A = A'$$

$$\therefore A = 2\alpha\beta = 2\alpha'\beta' = A'$$

Mehrfache Anordnungen eines Zykloids
in t-Richtung liefert occurrence graph (dies:
nach mehreren Parametern abh. Schließst)

Damit sind sehr genaue Maßstäbe
realisierbar (z.B. Atomuhr)

$$x' = \frac{\xi}{2\alpha'} + \frac{\eta}{2\beta'}$$

$$t' = \frac{\xi}{2\alpha'} - \frac{\eta}{2\beta'}$$

$$\xi = \alpha'(x' + t')$$

$$\eta = \beta'(x' - t')$$

$$\therefore \xi\eta = \alpha\beta(x^2 - t^2) = \alpha'\beta'(x'^2 - t'^2)$$

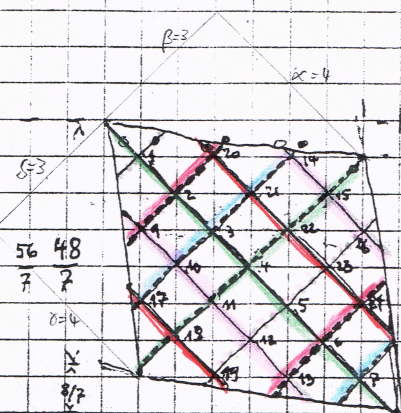
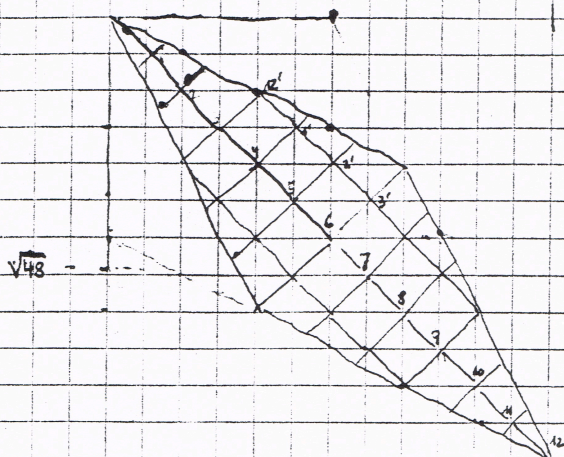
(6, 2, 6, 2)

$$v = w = \frac{6-2}{6+2} = \frac{1}{2}$$

$$1/L = \frac{4}{\sqrt{12}} = \frac{2}{\sqrt{3}} \quad L = \frac{\sqrt{3}}{2} = 0.85$$

$$A = 24 = 2 \cdot 6 \cdot 2$$

$$\sqrt{48} = 6.9282...$$



$\alpha = 4$ backw. fl. tok. $\propto (\beta, \gamma, \delta)$

$\beta = 3$ forw. fl. tokens $v = w = \frac{4-3}{4+3} = \frac{1}{7}$

$$A = 2 \cdot 4 \cdot 3 = 24$$

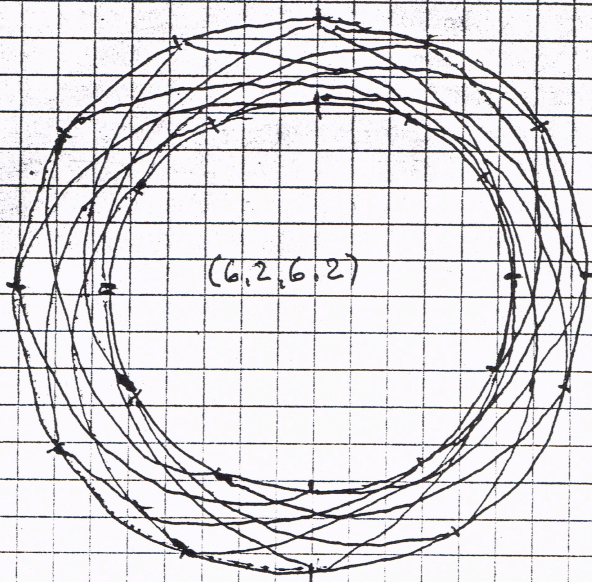
$$\frac{\text{add steps}}{\text{seq steps}} = \frac{\frac{8}{7}}{\frac{56}{7}} = \frac{8}{56}$$

$\gamma = 4$ backw. lines

$\delta = 3$ forw. lines

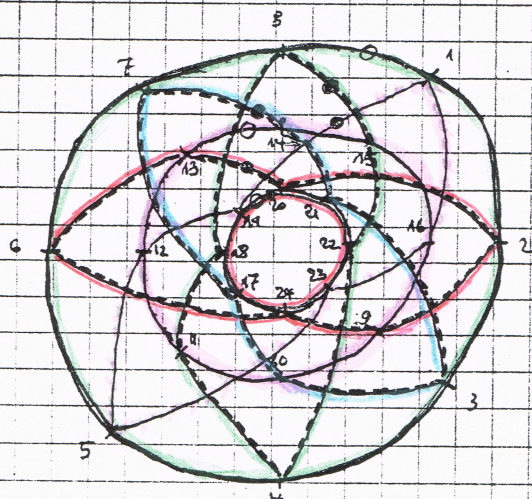
$$\frac{56}{7} - \frac{48}{7} = \frac{8}{7} = 1 + \frac{1}{7}$$

$$L = \sqrt{4 - \frac{1}{49}} = \sqrt{3 \cdot \frac{4}{7}} = 0.98974...$$



Clock repr $\approx$ Track repr

$$\Leftrightarrow \gamma = \alpha \wedge \delta = \beta \Leftrightarrow \text{Unit}$$



(4, 3, 4, 3) Clock

Superposition of velocities $v = f(v_1, v_2)$.

$$\text{In } \mathbb{R}^1 \times \mathbb{R}^1: \quad v = f(v_1, v_2) = \frac{v_1 + v_2}{1 + v_1 v_2} \quad (c=1)$$

properly: $\frac{v}{c} = \frac{\frac{v_1}{c} + \frac{v_2}{c}}{1 + \frac{v_1 v_2}{c^2}}, \quad v = \frac{v_1 + v_2}{1 + \frac{v_1 v_2}{c^2}}$

$$\frac{v}{c} = \frac{\gamma - \delta}{\gamma + \delta} = \frac{\frac{\gamma}{\delta} - 1}{\frac{\gamma}{\delta} + 1}, \quad \frac{\gamma}{\delta} \cdot \frac{v}{c} + \frac{v}{c} = \frac{\gamma}{\delta} - 1, \quad \frac{\gamma}{\delta} \left(\frac{v}{c} - 1 \right) = -\frac{v}{c} - 1$$

$$\frac{\gamma}{\delta} = \frac{1 + \frac{v}{c}}{1 - \frac{v}{c}} = \frac{1 + \frac{v_1}{c} + \frac{v_2}{c}}{1 + \frac{v_1 v_2}{c^2}} = \frac{1 + \frac{v_1 v_2}{c^2} + \frac{v_1}{c} + \frac{v_2}{c}}{1 + \frac{v_1 v_2}{c^2} - \frac{v_1}{c} - \frac{v_2}{c}} = \frac{(1 + \frac{v_1}{c})(1 + \frac{v_2}{c})}{(1 - \frac{v_1}{c})(1 - \frac{v_2}{c})} = \frac{\gamma_1}{\delta_1} \cdot \frac{\gamma_2}{\delta_2}$$

Thm:

$$\boxed{\frac{\gamma_1}{\delta_1} \cdot \frac{\gamma_2}{\delta_2} = \frac{\gamma}{\delta}} \quad (\text{all Integers } \geq 2)$$

$$\log \gamma_1 - \log \delta_1 + \log \gamma_2 - \log \delta_2 = \log \gamma - \log \delta$$

$$\log \frac{\gamma_1}{\delta_1} + \log \frac{\gamma_2}{\delta_2} = \log \frac{\gamma}{\delta} \quad (\text{arbitrary base})$$

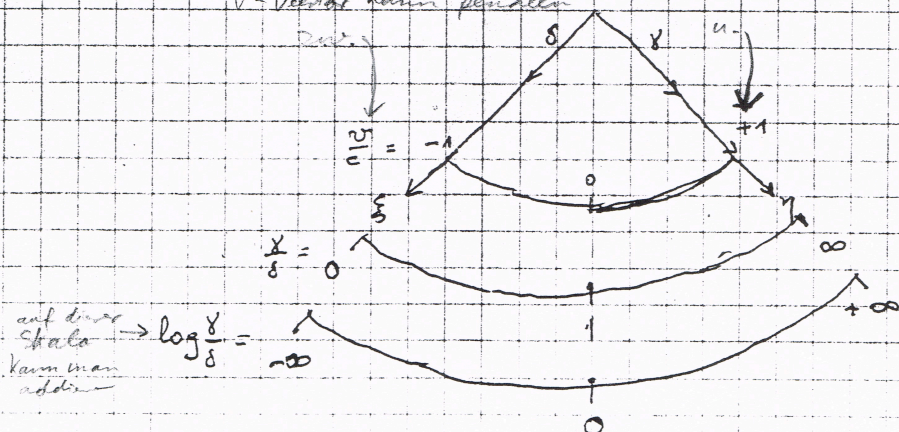
$$\left(\Leftrightarrow \right. \quad \text{Arctan } \frac{v_1}{c} + \text{Arctan } \frac{v_2}{c} = \text{Arctan } \frac{v}{c} \quad (\text{Eddington})$$

„Reel-schieber & Superposition v. Geschw. d. Addition“
v-Vektors kann parallel

likewise: since $\frac{\alpha}{\beta} = \frac{\gamma}{\delta}$,

$$\boxed{\frac{\alpha_1}{\beta_1} \cdot \frac{\alpha_2}{\beta_2} = \frac{\alpha}{\beta}}$$

Superposition of retardations



P: Komposition von

Multiplication v. Zykloiden $(\alpha_1 \beta_1 \gamma_1 \delta_1) * (\alpha_2 \beta_2 \gamma_2 \delta_2) = (\alpha_1 \alpha_2 \beta_1 \beta_2 \gamma_1 \gamma_2 \delta_1 \delta_2) = (\alpha \beta \gamma \delta)$