Informational Time

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I call any subjects, connected with an information the informational objects. It is clear that information received from such informational object can be expressed by a text which is made of sentences. I call a set of sentences expressing information about some informational object recorder of this object. Some recorders systems form structures similar to clocks. The following results are obtained from the logical properties of a set of recorders: First, all such clocks have the same direction, i.e. if an event expressed by sentence A precedes an event expressed by sentence B according to one of such clocks then it is true according to the others. Secondly, time is irreversible according to these clocks, i.e. there's no recorder which can receive information about an event that has happened until this event really happens Thirdly, a set of recorders is naturally embedded into metrical space. Fourthly, if this metrical space is Euclidean, then the corresponding "space and time" of recorders obeys to transformations of the complete Poincare group. If this metric space is not Euclidean then suitable non-linear geometry may be built in this space.

Here I use numbering of definitions and theorems from book [1] which contains detailed proofs of all these theorems.

1 Recorders

Any information, received from physical devices, can be expressed by a text, made of sentences.

Let $\widehat{\mathbf{a}}$ be some object which is able to receive, save, and/or transmit an information. A set $\mathbf{a}$ of sentences, expressing an information of an object $\widehat{\mathbf{a}}$, is called *a recorder* of this object. Thus, statement: "Sentence $\ll A \gg$ is an element of the set $\mathbf{a}$" denotes: "$\widehat{\mathbf{a}}$ has information that the event, expressed by sentence $\ll A \gg$, took place". In short: "$\widehat{\mathbf{a}}$ knows that A". Or by designation: "$\mathbf{a}^{\bullet} \ll A \gg$".

Obviously, the following conditions are satisfied:

I. For any $\mathbf{a}$ and for every A: false is that $\mathbf{a}^{\bullet}(A\& (\neg A))$, thus, any recorder doesn't contain a logical contradiction;

II. For every $\mathbf{a}$, every B, and all A: if B is a logical consequence from A, and $\mathbf{a}^{\bullet}A$, then $\mathbf{a}^{\bullet}B$;

*III. For all $\mathbf{a}$, $\mathbf{b}$ and for every A: if $\mathbf{a}^{\bullet} \ll \mathbf{b}^{\bullet}A \gg$ then $\mathbf{a}^{\bullet}A$.

2 Time

Let's consider finite (probably empty) path of symbols of form $\mathbf{q}^{\bullet}$.

Def. 1.3.1: A path α is *a subpath* of a path β (design.: $\alpha \prec \beta$) if α can be got from β by deletion of some (probably all) elements.

Designation: $(\alpha)^1$ is α, and $(\alpha)^{k+1}$ is $\alpha\,(\alpha)^k$.

Therefore, if $k \leqslant l$ then $(\alpha)^k \prec (\alpha)^l$.

Def. 1.3.2: A path α is *equivalent* to a path β (design.: $\alpha \sim \beta$) if α can be got from β by substitution of a subpath of form $(\mathbf{a}^{\bullet})^k$ by a path of the same form $(\mathbf{a}^{\bullet})^s$.

In this case:

III. If $\beta \prec \alpha$ or $\beta \sim \alpha$ then for any K: if $\mathbf{a}^{\bullet}K$ then $\mathbf{a}^{\bullet}(K\& (\alpha A \Rightarrow \beta A))$.

Obviously, III is a refinement of condition *III.

Def. 1.3.3: A natural number q is *instant*, at which a registrates B according to *κ-clock* $\{\mathbf{g}_0, A, \mathbf{b}_0\}$ (design.: q is $[\mathbf{a}^{\bullet}B \uparrow \mathbf{a}, \{\mathbf{g}_0, A, \mathbf{b}_0\}]$) if:

1. for any K: if $\mathbf{a}^{\bullet}K$ then

$$\mathbf{a}^{\bullet}\left(K\&\left(\mathbf{a}^{\bullet}B \Rightarrow \mathbf{a}^{\bullet}\left(\mathbf{g}_0^{\bullet}\mathbf{b}_0^{\bullet}\right)^q \mathbf{g}_0^{\bullet}A\right)\right)$$

and

$$\mathbf{a}^{\bullet}\left(K\&\left(\mathbf{a}^{\bullet}\left(\mathbf{g}_0^{\bullet}\mathbf{b}_0^{\bullet}\right)^{q+1} \mathbf{g}_0^{\bullet}A \Rightarrow \mathbf{a}^{\bullet}B\right)\right).$$

2. $\mathbf{a}^{\bullet}\left(\mathbf{a}^{\bullet}B\&\left(\neg\mathbf{a}^{\bullet}\left(\mathbf{g}_0^{\bullet}\mathbf{b}_0^{\bullet}\right)^{q+1} \mathbf{g}_0^{\bullet}A\right)\right).$

Def. 1.3.4: *κ*-clocks $\{\mathbf{g}_1, B, \mathbf{b}_1\}$ and $\{\mathbf{g}_2, B, \mathbf{b}_2\}$ have *the same direction* for $\mathbf{a}$ if the following condition is satisfied: If

$$r = \left[\mathbf{a}^{\bullet}\left(\mathbf{g}_1^{\bullet}\mathbf{b}_1^{\bullet}\right)^q \mathbf{g}_1^{\bullet}B \uparrow \mathbf{a}, \{\mathbf{g}_2, B, \mathbf{b}_2\}\right],$$

$$s = \left[\mathbf{a}^{\bullet}\left(\mathbf{g}_1^{\bullet}\mathbf{b}_1^{\bullet}\right)^p \mathbf{g}_1^{\bullet}B \uparrow \mathbf{a}, \{\mathbf{g}_2, B, \mathbf{b}_2\}\right],$$

$$q < p,$$

then

$$r \leqslant s\,.$$

Th. 1.3.1: All *κ*-clocks have the same direction. Consequently, a recorder orders its sentences with respect to instants. Moreover, this order is linear and it doesn't matter according to which *κ*-clock it is established.

Def. 1.3.5: *κ*-clock $\{\mathbf{g}_2, B, \mathbf{b}_2\}$ is k times more precise than *κ*-clock $\{\mathbf{g}_1, B, \mathbf{b}_1\}$ for recorder $\mathbf{a}$ if for every C the following condition is satisfied: if

$$q_1 = [\mathbf{a}^\bullet C \uparrow \mathbf{a}, \{\mathbf{g}_1, B, \mathbf{b}_1\}],$$
$$q_2 = [\mathbf{a}^\bullet C \uparrow \mathbf{a}, \{\mathbf{g}_2, B, \mathbf{b}_2\}],$$

then

$$q_1 < \tfrac{q_2}{k} < q_1 + 1.$$

Def. 1.3.6: A sequence $\widetilde{H}$ of κ-clocks:

$$\left\langle \{\mathbf{g}_0, A, \mathbf{b}_0\},\ \{\mathbf{g}_1, A, \mathbf{b}_2\}, \ldots, \left\{\mathbf{g}_j, A, \mathbf{b}_j\right\},\ \ldots \right\rangle$$

is called *an absolutely precise* κ-clock of a recorder $\mathbf{a}$ if for every j exists a natural number k_j so that κ-clock$\left\{\mathbf{g}_j, A, \mathbf{b}_j\right\}$ is k_j times more precise than κ-clock$\left\{\mathbf{g}_{j-1}, A, \mathbf{b}_{j-1}\right\}$.

In this case if

$$q_j = \left[\mathbf{a}^\bullet C \uparrow \mathbf{a}, \left\{\mathbf{g}_j, A, \mathbf{b}_j\right\}\right]$$

and

$$t = q_0 + \sum_{j=1}^{\infty} \frac{q_j - q_{j-1} \cdot k_j}{k_1 \cdot k_2 \cdot \ldots \cdot k_j},$$

then

$$t \text{ is } \left[\mathbf{a}^\bullet C \uparrow \mathbf{a}, \widetilde{H}\right].$$

3 Space

Def. 1.4.1: A number t is called *a time, measured by a recorder* $\mathbf{a}$ *according to a* κ*-clock* $\widetilde{H}$*, during which a signal* C *did a path* $\mathbf{a}^\bullet \alpha \mathbf{a}^\bullet$, design.:

$$t := \mathfrak{m}\left(\mathbf{a}\widetilde{H}\right)(\mathbf{a}^\bullet \alpha \mathbf{a}^\bullet C),$$

if

$$t = \left[\mathbf{a}^\bullet \alpha \mathbf{a}^\bullet C \uparrow \mathbf{a}, \widetilde{H}\right] - \left[\mathbf{a}^\bullet C \uparrow \mathbf{a}, \widetilde{H}\right].$$

Th. 1.4.1:

$$\mathfrak{m}\left(\mathbf{a}\widetilde{H}\right)(\mathbf{a}^\bullet \alpha \mathbf{a}^\bullet C) \geqslant 0.$$

Def. 1.4.2:

1) for every recorder $\mathbf{a}$: $(\mathbf{a}^\bullet)^\dagger = (\mathbf{a}^\bullet)$;
2) for all paths α and β: $(\alpha\beta)^\dagger = (\beta)^\dagger\,(\alpha)^\dagger$.

Def. 1.4.3: A set $\mathfrak{R}$ of recorders is *an internally stationary system* for a recorder $\mathbf{a}$ with a κ-clock $\widetilde{H}$ (design.: $\mathfrak{R}$ is $ISS\left(\mathbf{a}, \widetilde{H}\right)$) if for all sentences B and C, for all elements $\mathbf{a}_1$ and $\mathbf{a}_2$ of set $\mathfrak{R}$, and for all paths α, made of elements of set $\mathfrak{R}$, the following conditions are satisfied:

1) $\left[\mathbf{a}^\bullet \mathbf{a}_2^\bullet \mathbf{a}_1^\bullet C \uparrow \mathbf{a}, \widetilde{H}\right] - \left[\mathbf{a}^\bullet \mathbf{a}_1^\bullet C \uparrow \mathbf{a}, \widetilde{H}\right] =$
$=\left[\mathbf{a}^\bullet \mathbf{a}_2^\bullet \mathbf{a}_1^\bullet B \uparrow \mathbf{a}, \widetilde{H}\right] - \left[\mathbf{a}^\bullet \mathbf{a}_1^\bullet B \uparrow \mathbf{a}, \widetilde{H}\right]$;
2) $\mathfrak{m}\left(\mathbf{a}\widetilde{H}\right)(\mathbf{a}^\bullet \alpha \mathbf{a}^\bullet C) = \mathfrak{m}\left(\mathbf{a}\widetilde{H}\right)\left(\mathbf{a}^\bullet \alpha^\dagger \mathbf{a}^\bullet C\right)$.

Th. 1.4.2:

$$\{\mathbf{a}\} - ISS\left(\mathbf{a}, \widetilde{H}\right).$$

Def. 1.4.4: A number l is called *an* $\mathbf{a}\widetilde{H}(B)$*-measure* of recorders $\mathbf{a}_1$ and $\mathbf{a}_2$, design.:

$$l = \ell\left(\mathbf{a}, \widetilde{H}, B\right)(\mathbf{a}_1, \mathbf{a}_2)$$

if

$$l = 0.5 \cdot \left(\left[\mathbf{a}^\bullet \mathbf{a}_1^\bullet \mathbf{a}_2^\bullet \mathbf{a}_1^\bullet B \uparrow \mathbf{a}, \widetilde{H}\right] - \left[\mathbf{a}^\bullet \mathbf{a}_1^\bullet B \uparrow \mathbf{a}, \widetilde{H}\right]\right).$$

Th. 1.4.3: If $\{\mathbf{a}, \mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3\}$ is $ISS\left(\mathbf{a}, \widetilde{H}\right)$ then

1) $\ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_1, \mathbf{a}_2) \geqslant 0$;
2) $\ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_1, \mathbf{a}_1) = 0$;
3) $\ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_1, \mathbf{a}_2) = \ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_2, \mathbf{a}_1)$;
4) $\ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_1, \mathbf{a}_2) + \ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_2, \mathbf{a}_3) \geqslant \ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_1, \mathbf{a}_3)$.

Thus, all four axioms of the metrical space are accomplished for $\ell\left(\mathbf{a}, \widetilde{H}\right)$ in an internally stationary systeminternally stationary system of recorders.

Consequently, $\ell\left(\mathbf{a}, \widetilde{H}\right)$ is a distance length similitude in this space.

Def. 1.4.6: B took place *in the same place as* $\mathbf{a}_1$ *for* $\mathbf{a}$ (design.: $\natural(\mathbf{a})(\mathbf{a}_1, B)$) if for every sequence α and for any sentence K the following condition is satisfied: if $\mathbf{a}^\bullet K$ then $\mathbf{a}^\bullet\left(K \& (\alpha B \Rightarrow \alpha \mathbf{a}_1^\bullet B)\right)$.

Th. 1.4.4:

$$\natural(\mathbf{a})\left(\mathbf{a}_1, \mathbf{a}_1^\bullet B\right).$$

Th. 1.4.5: If

$$\natural(\mathbf{a})(\mathbf{a}_1, B), \tag{1}$$
$$\natural(\mathbf{a})(\mathbf{a}_2, B), \tag{2}$$

then

$$\natural(\mathbf{a})(\mathbf{a}_2, \mathbf{a}_1^\bullet B).$$

Th. 1.4.6: If $\{\mathbf{a}, \mathbf{a}_1, \mathbf{a}_2\}$ is $ISS\left(\mathbf{a}, \widetilde{H}\right)$,

$$\natural(\mathbf{a})(\mathbf{a}_1, B), \tag{3}$$
$$\natural(\mathbf{a})(\mathbf{a}_2, B), \tag{4}$$

then

$$\ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_1, \mathbf{a}_2) = 0.$$

Th. 1.4.7: If $\{\mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3\}$ is $ISS\left(\mathbf{a}, \widetilde{H}\right)$ and there exists sentence B such that

$$\natural(\mathbf{a})(\mathbf{a}_1, B), \tag{5}$$
$$\natural(\mathbf{a})(\mathbf{a}_2, B), \tag{6}$$

then

$$\ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_3, \mathbf{a}_2) = \ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_3, \mathbf{a}_1).$$

Def. 1.4.7: A real number t is an instant of a sentence B in *frame of reference* $\left(\mathfrak{R}\mathbf{a}\widetilde{H}\right)$, design.:

$$t = \left[B \mid \mathfrak{R}\mathbf{a}\widetilde{H}\right],$$

if

1) $\Re$ is $ISS\left(\mathbf{a}, \widetilde{H}\right)$,

2) there exists a recorder $\mathbf{b}$ so that $\mathbf{b} \in \Re$ and $\natural(\mathbf{a})(\mathbf{b}, B)$,

3) $t = \left[\mathbf{a}^{\bullet} B \uparrow \mathbf{a}, \widetilde{H}\right] - \ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}, \mathbf{b})$.

Def. 1.4.8: A real number z is *a distance length* between B and C in a frame of reference $\left(\Re\mathbf{a}\widetilde{H}\right)$, design.:

$$z = \ell\left(\Re\mathbf{a}\widetilde{H}\right)(B, C),$$

if

1) $\Re$ is $ISS\left(\mathbf{a}, \widetilde{H}\right)$,

2) there exist recorders $\mathbf{a}_1$ and $\mathbf{a}_2$ so that $\mathbf{a}_1 \in \Re$, $\mathbf{a}_2 \in \Re$, $\natural(\mathbf{a})(\mathbf{a}_1, B))$ and $\natural(\mathbf{a})(\mathbf{a}_2, C))$,

3) $z = \ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_2, \mathbf{a}_1)$.

According to Theorem 1.4.3 such distance length satisfies conditions of all axioms of a metric space.

4 Relativity

Def. 1.5.1: Recorders $\mathbf{a}_1$ and $\mathbf{a}_2$ *equally receive a signal* about B for a recorder $\mathbf{a}$ if

$$\ll \natural(\mathbf{a})\left(\mathbf{a}_2, \mathbf{a}_1^{\bullet} B\right) \gg\, = \,\ll \natural(\mathbf{a})\left(\mathbf{a}_1, \mathbf{a}_2^{\bullet} B\right) \gg.$$

Def. 1.5.2: Set of recorders are called *a homogeneous space of recorders*, if all its elements equally receive all signals.

Def. 1.5.3: A real number c is *an information velocity about B to the recorder* $\mathbf{a}_1$ in a frame of reference $\left(\Re\mathbf{a}\widetilde{H}\right)$ if

$$c = \frac{\ell\left(\Re\mathbf{a}\widetilde{H}\right)\left(B, \mathbf{a}_1^{\bullet} B\right)}{\left[\mathbf{a}_1^{\bullet} B \mid \Re\mathbf{a}\widetilde{H}\right] - \left[B \mid \Re\mathbf{a}\widetilde{H}\right]}.$$

Th. 1.5.1: In all homogeneous spaces:

$$c = 1.$$

That is in every homogenous space a propagation velocity of every information to every recorder for every frame reference equals to 1.

Th. 1.5.2: If $\Re$ is a homogeneous space, then

$$\left[\mathbf{a}_1^{\bullet} B \mid \Re\mathbf{a}\widetilde{H}\right] \geqslant \left[B \mid \Re\mathbf{a}\widetilde{H}\right].$$

Consequently, in any homogeneous space any recorder finds out that B "took place" not earlier than B "actually take place". "Time" is irreversible.

Th. 1.5.3: If $\mathbf{a}_1$ and $\mathbf{a}_2$ are elements of $\Re$,

$$\Re is ISS\left(\mathbf{a}, \widetilde{H}\right), \tag{7}$$

$$p := \left[\mathbf{a}_1^{\bullet} B \mid \Re\mathbf{a}\widetilde{H}\right], \tag{8}$$

$$q := \left[\mathbf{a}_2^{\bullet}\mathbf{a}_1^{\bullet} B \mid \Re\mathbf{a}\widetilde{H}\right], \tag{9}$$

$$z := \ell\left(\Re\mathbf{a}\widetilde{H}\right)(\mathbf{a}_1, \mathbf{a}_2),$$

then

$$z = q - p.$$

According to Urysohn's theorem* [2]: any homogeneous space is homeomorphic to some set of points of real Hilbert space. If this homeomorphism is not Identical transformation, then $\Re$ will represent a non- Euclidean space. In this case in this "space-time" corresponding variant of General Relativity Theory can be constructed. Otherwise, $\Re$ is Euclidean space. In this case there exists *coordinates system* R^{μ} such that the following condition is satisfied: for all elements $\mathbf{a}_1$ and $\mathbf{a}_2$ of set $\Re$ there exist points $\mathbf{x}_1$ and $\mathbf{x}_2$ of system R^{μ} such that

$$\ell\left(\mathbf{a}, \widetilde{H}\right)(\mathbf{a}_k, \mathbf{a}_s) = \left(\sum_{j=1}^{\mu}\left(x_{s,j} - x_{k,j}\right)^2\right)^{0.5}.$$

In this case R^{μ} is called *a coordinates system of frame of reference* $\left(\Re\mathbf{a}\widetilde{H}\right)$ and numbers $\left\langle x_{k,1}, x_{k,2}, \ldots, x_{k,\mu}\right\rangle$ are called *coordinates of recorder* $\mathbf{a}_k$ in R^{μ}.

A coordinates system of a frame of reference is specified accurate to transformations of shear, turn, and inversion.

Def. 1.5.4: Numbers $\left\langle x_1, x_2, \ldots, x_{\mu}\right\rangle$ are called *coordinates* of B in *a coordinate system* R^{μ} of *a frame of reference* $\left(\Re\mathbf{a}\widetilde{H}\right)$ if there exists a recorder $\mathbf{b}$ such that $\mathbf{b} \in \Re$, $\natural(\mathbf{a})(\mathbf{b}, B)$ and these numbers are the coordinates in R^{μ} of this recorder.

Th. 1.5.4: In a coordinate system R^{μ} of a frame of reference $\left(\Re\mathbf{a}\widetilde{H}\right)$: if z is a distance length between B and C, coordinates of B are

$$(b_1, b_2, \ldots, b_n)$$

coordinates of C are

$$(c_1, c_2, \ldots, c_3)$$

then

$$z = \left(\sum_{j=1}^{\mu}\left(c_j - b_j\right)^2\right)^{0.5}.$$

Def. 1.5.5: Numbers $\left\langle x_1, x_2, \ldots, x_{\mu}\right\rangle$ are called *coordinates of the recor-der* $\mathbf{b}$ *in the coordinate system* R^{μ} *at the instant t of the frame of reference* $\left(\Re\mathbf{a}\widetilde{H}\right)$ if for every B the condition is satisfied: if

$$t = \left[\mathbf{b}^{\bullet} B \mid \Re\mathbf{a}\widetilde{H}\right]$$

then coordinates of $\ll \mathbf{b}^{\bullet} B \gg$ in coordinate system R^{μ} of frame of reference $\left(\Re\mathbf{a}\widetilde{H}\right)$ are the following:

$$\left\langle x_1, x_2, \ldots, x_{\mu}\right\rangle.$$

Let v be the real number such that $|v| < 1$.

*Pavel Samuilovich Urysohn, a.k.a. Pavel Uryson (February 3, 1898, Odessa — August 17, 1924, Batz-sur-Mer) was a Jewish mathematician who is best known for his contributions in the theory of dimension, and for developing Urysohn's Metrization Theorem and Urysohn's Lemma, both of which are fundamental results in topology.

Th. 1.5.5: In a coordinates system R^{μ} of a frame of reference $\left(\Re\mathbf{a}\widetilde{H}\right)$: if in every instant t: coordinates of*:

$$\mathbf{b}:\left\langle x_{\mathbf{b},1}+v\cdot t,x_{\mathbf{b},2},x_{\mathbf{b},3},\ldots,x_{\mathbf{b},\mu}\right\rangle,$$
$$\mathbf{g}_0:\left\langle x_{0,1}+v\cdot t,x_{0,2},x_{0,3},\ldots,x_{0,\mu}\right\rangle,$$
$$\mathbf{b}_0:\left\langle x_{0,1}+v\cdot t,x_{0,2}+l,x_{0,3},\ldots,x_{0,\mu}\right\rangle,$$

and

$$t_C=\left[\mathbf{b}^{\bullet}C\mid\Re\mathbf{a}\widetilde{H}\right],$$
$$t_D=\left[\mathbf{b}^{\bullet}D\mid\Re\mathbf{a}\widetilde{H}\right],$$
$$q_C=\left[\mathbf{b}^{\bullet}C\uparrow\mathbf{b},\{\mathbf{g}_0,A,\mathbf{b}_0\}\right],$$
$$q_D=\left[\mathbf{b}^{\bullet}D\uparrow\mathbf{b},\{\mathbf{g}_0,A,\mathbf{b}_0\}\right],$$

then

$$\lim_{l\to 0}2\cdot\frac{l}{\sqrt{(1-v^2)}}\cdot\frac{q_D-q_C}{t_D-t_C}=1.$$

Consequently, moving at speed v κ-clock are times slower than the one at rest.

Th. 1.5.6: Let: v ($|v|<1$) and l be real numbers and k_i be natural ones.

Let in a coordinates system R^{μ} of a frame of reference $\left(\Re\mathbf{a}\widetilde{H}\right)$: in each instant t coordinates of

$$\mathbf{b}:\left\langle x_{b,1}+v\cdot t,x_{b,2},x_{b,3},\ldots,x_{b,\mu}\right\rangle,$$
$$\mathbf{g}_j:\left\langle y_{j,1}+v\cdot t,y_{j,2},y_{j,3},\ldots,y_{j,\mu}\right\rangle,$$
$$\mathbf{u}_j:\left\langle y_{j,1}+v\cdot t,y_{j,2}+l/\left(k_1\cdot\ldots\cdot k_j\right),y_{j,3},\ldots,y_{j,\mu}\right\rangle,$$

for all $\mathbf{b}_i$: if $\mathbf{b}_i\in\Im$, then coordinates of

$$\mathbf{b}_i:\left\langle x_{i,1}+v\cdot t,x_{i,2},x_{i,3},\ldots,x_{i,\mu}\right\rangle,$$
$$\widetilde{T}\text{ is }\left\langle\{\mathbf{g}_1,A,\mathbf{u}_1\},\ \{\mathbf{g}_2,A,\mathbf{u}_2\},\ldots,\left\{\mathbf{g}_j,A,\mathbf{u}_j\right\},\ldots\right\rangle.$$

In that case: $\Im$ is $ISS\left(\mathbf{b},\widetilde{T}\right)$.

Therefore, a inner stability survives on a uniform straight line motion.

Th. 1.5.7: Let:

1) in a coordinates system R^{μ} of a frame of reference $\left(\Re\mathbf{a}\widetilde{H}\right)$ in every instant t:

$$\mathbf{b}:\left\langle x_{\mathbf{b},1}+v\cdot t,x_{\mathbf{b},2},x_{\mathbf{b},3},\ldots,x_{\mathbf{b},\mu}\right\rangle,$$
$$\mathbf{g}_j:\left\langle y_{j,1}+v\cdot t,y_{j,2},y_{j,3},\ldots,y_{j,\mu}\right\rangle,$$
$$\mathbf{u}_j:\left\langle y_{j,1}+v\cdot t,y_{j,2}+l/\left(k_1\cdot\ldots\cdot k_j\right),y_{j,3},\ldots,y_{j,\mu}\right\rangle,$$

for every recorder $\mathbf{q}_i$: if $\mathbf{q}_i\in\Im$ then coordinates of

$$\mathbf{q}_i:\left\langle x_{i,1}+v\cdot t,x_{i,2},x_{i,3},\ldots,x_{i,\mu}\right\rangle,$$
$$\widetilde{T}\text{ is }\left\langle\{\mathbf{g}_1,A,\mathbf{u}_1\},\ \{\mathbf{g}_2,A,\mathbf{u}_2\},\ldots,\left\{\mathbf{g}_j,A,\mathbf{u}_j\right\},\ \ldots\right\rangle,$$

$$C:\left\langle C_1,C_2,C_3,\ldots,C_{\mu}\right\rangle,$$
$$D:\left\langle D_1,D_2,D_3,\ldots,D_{\mu}\right\rangle,$$
$$t_C=\left[C\mid\Re\mathbf{a}\widetilde{H}\right],$$
$$t_D=\left[D\mid\Re\mathbf{a}\widetilde{H}\right];$$

2) in a coordinates system $R^{\mu\prime}$ of a reference frame $\left(\Im\mathbf{b}\widetilde{T}\right)$:

$$C:\left\langle C'_1,C'_2,C'_3,\ldots,C'_{\mu}\right\rangle,$$
$$D:\left\langle D'_1,D'_2,D'_3,\ldots,D'_{\mu}\right\rangle,$$
$$t'_C=\left[C\mid\Im\mathbf{b}\widetilde{T}\right],$$
$$t'_D=\left[D\mid\Im\mathbf{b}\widetilde{T}\right].$$

In that case:

$$t'_D-t'_C=\frac{(t_D-t_C)-v\,(D_1-C_1)}{\sqrt{1-v^2}},$$
$$D'_1-C'_1=\frac{(D_1-C_1)-v\,(t_D-t_C)}{\sqrt{1-v^2}}.$$

This is the Lorentz spatial-temporal transformation.

Conclusion

Thus, if you have some set of objects, dealing with information, then "time" and "space" are inevitable. And it doesn't matter whether this set is part our world or some other worlds, which don't have a space-time structure initially.

I call such "Time" the Informational Time.

Since, we get our time together with our information system all other notions of time (thermodynamical time, cosmological time, psychological time, quantum time etc.) should be defined by that Informational Time.

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*Below v is a real positive number such that $|v|<1$.