of phase-time. Different event-phases will make contributions to the resultant complete complex of compresence with varying weights; and this variable factor of weight in the superposition process is what I call 'gravitas,' meaning by this term a *non-temporal* factor representing the analogue of amplitude, or weight, in the superposition of wave functions in physics. We can then say that the contribution which each event-phase makes to a total momentary experience is proportional to its gravitas, or 'degree of presentedness.' And if the standpoint of psycho-physical parallelism, common to Russell's theory and mine, is adopted, we can extend this analysis to physical events and processes as well. Gravitas (or degree of presentedness) will then be the psychological analogue of the weight or amplitude of wave-functions in a quantum-superposition of states in a dynamical system which undergoes changes in transition-time. It will be as if at each unit of transition-time, corresponding to a total momentary experience, there is a full fledged spread of compresent event-phases, between which relations of 'earlier than' and 'later than' obtain in phase-time. That some of these event-phases precede others in phase-time is important; but the essential point is that nonetheless they are all contemporary or compresent, at a particular moment, though some will fade out before others.

H. A. C. Dobbs

A Logistic Analysis of the Two-fold Time Theory of the Specious Present, by Professor C. D. Broad (expressed in the symbolism of *Principia Mathematica*).

General Notions. Let us say that an *instantaneous event phase occupies* an *instant* t; and denote this by

$$ePt.$$

Let us say that it is presented to a subject s at a *moment* T and with a certain gravitas or *degree of presentedness* g; and denote this by

$$e\prod_s^g \mathrm{T}.$$

It will be convenient to write for $(\exists g)\, e\prod_s^g \mathrm{T}$ the simple formula

$$e\prod_s \mathrm{T}.$$

N.B.—If it is held that degree of presentedness is a property only of *processes* with a finite duration in the t-dimension, what I have called 'degree of presentedness' will be the rate of change of what will then be called 'degree of presentedness' with t. Cf. 'total utility' and 'marginal utility' in economics.

Assumptions 1.1 *and* 1.2. I assume that instants form a continuous one-dimensional open endless series ordered by a relation I, and that *moments* form a series of the same kind ordered by a relation M. I shall write

$$T' >_M T$$

for ' the moment T′ comes later in the series of moments than the moment T.' And

$$t' >_I t$$

will have the same meaning with ' instant ' substituted for ' moment '.

N.B.—I suppose that to call the series of instants and the series of moments the ' dimensions ' of a single variable called ' time ' entails that ' M ' and ' I ' are just two different names for the same relation. I think it is best not to assume this tacitly, but to assert it explicitly if one wants to hold that view.

Assumptions 2.1, 2.2 *and* 2.3. I assume that

$$ePt \text{ and } ePt' : \rightarrow t = t', \text{ i.e. } Pe\, Cls \rightarrow 1 \quad . \quad . \quad (2.1)$$

Also $$e \prod\nolimits_s^g T \text{ and } e \prod\nolimits_s^g T' : \rightarrow T = T', \text{ i.e. } \prod\nolimits_s^g e\, Cls \rightarrow 1 \quad . \quad (2.2)$$

But $\prod_s$ is *not* $Cls \rightarrow 1$, for the same instantaneous event may be presented to S (though not with the same degree of presentedness) at several different moments. . . . . (2.3)

Since an event e can occupy one and only one instant we can talk of ' *the* instant occupied by e.' This will be denoted in the usual way by

$$\overset{\cup}{P} {}^{\backprime} e.$$

The class of moments at which an event e is presented to s will be denoted, as usual, by

$$\overleftarrow{\prod}_s {}^{\backprime} e.$$

Assumption 3. I assume that, if e and e' occupy the same instant, then the class of moments at which e is presented to s is identical with the class of moments at which e' is presented to s, i.e.

$$\overset{\cup}{P} {}^{\backprime} e = \overset{\cup}{P} {}^{\backprime} e' \rightarrow \overleftarrow{\prod}_s {}^{\backprime} e = \overleftarrow{\prod}_s {}^{\backprime} e'. \quad . \quad . \quad . \quad (3)$$

Now we can define the class $\lambda_{s,t,e}$ as the class of all the moments at which an event e which occupies the instant t is presented to s. Thus

$$\lambda_{s,t,e} = (\hat{T})[ePt \,.\, \supset_e . \, e \prod\nolimits_s T].$$

But in virtue of Assumption (3) $\lambda_{s,t,e} = \lambda_{s,t,e'}$. So we can drop the e and denote the class simply by $\lambda_{s,t}$. So $\lambda_{s,t}$ is the class of *moments* such that *any* instantaneous event occupying the *instant* t would be presented to s at *all* these *moments*.

Now there is obviously another class complementary to $\lambda_{s,t}$. This is the class of *instants* such that an event which occupies *any* of these *instants* is presented to s at a given *moment* T. We can denote this by $\mu_{s,T}$. We have

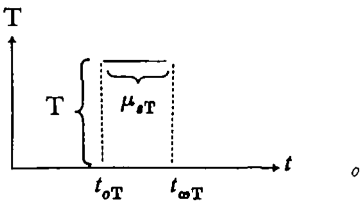
$$\mu_{s,T} = \overset{\wedge}{(t)}[e P t . \supset_s . e \prod_s T].$$

Empirical facts about normal Specious Presents:

(1) For any moment T the members of $\mu_{s,T}$ form a *single continuous* segment of *finite* length ordered by the relation I. Thus we can talk of the upper and the lower bounds of μ_{sT}, and we have

$$(T) : E \,!\, \mathrm{limin}_I \text{ ‘ } \mu_{sT} \;\&\; E \,!\, \mathrm{limax}_I \text{ ‘ } \mu_{sT}.$$

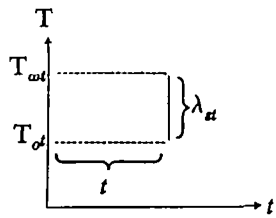
It will be convenient to denote these instants by $t_{\alpha t}$ and $t_{\omega t}$ respectively.



(2) For any instant t the members of λ_{st} form a *single continuous* segment of *finite* length ordered by the relation M. Thus we can talk of the upper and the lower bounds of λ_{st}, and we have

$$(t) : E \,!\, \mathrm{limin}_M \text{ ‘ } \lambda_{st} \;\&\; E \,!\, \mathrm{limax}_M \text{ ‘ } \lambda_{st}.$$

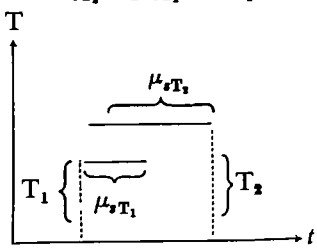
It will be convenient to denote these moments by $T_{\alpha t}$ and $T_{\omega t}$ respectively.



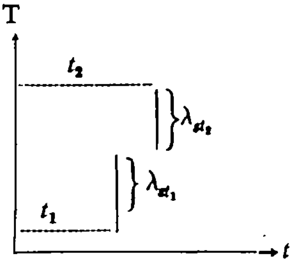
(1.1) If $T_2 >_M T_1$ then $\mathrm{limin}_I \text{ ‘ } \mu_{sT_2} >_I \mathrm{limin}_I \, \mu_{sT_1}$,

and $\mathrm{limax}_I \text{ ‘ } \mu_{sT_2} >_I \mathrm{limax}_I \, \mu_{sT_1}$,

i.e. $t_{oT_2} >_I t_{oT_1} \;\&\; t_{\omega T_2} >_I t_{\omega T_1}$.



(2.1) Similarly, *mutatis mutandis*, for λ_{st_1} and λ_{st_2} if $t_2 >_{\mathrm{I}} t_1$,

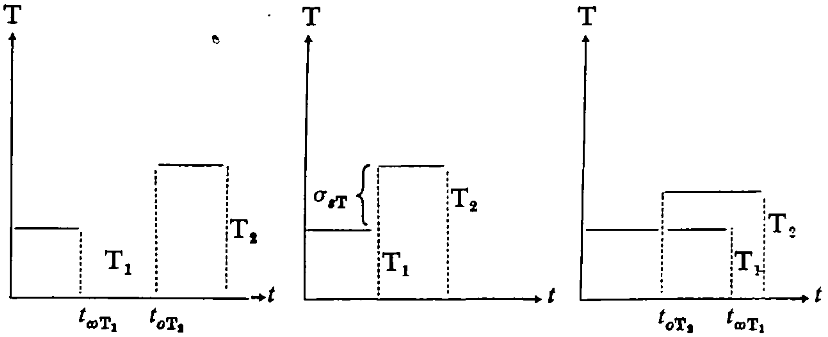


(1.2) There is a certain magnitude σ_{sT}, such that,

if $\quad T_2 - T_1 > \sigma_{sT}$, then $t_{\omega T_1} <_{\mathrm{I}} t_{oT_2}$;

if $\quad T_2 - T_1 = \sigma_{sT}$, then $t_{\omega T_1} = t_{oT_2}$;

and if $\quad T_2 - T_1 < \sigma_{sT}$, then $t_{\omega T_1} \in \mu_{sT_1}$ and $t_{oT_2} \in \mu_{sT_1}$.

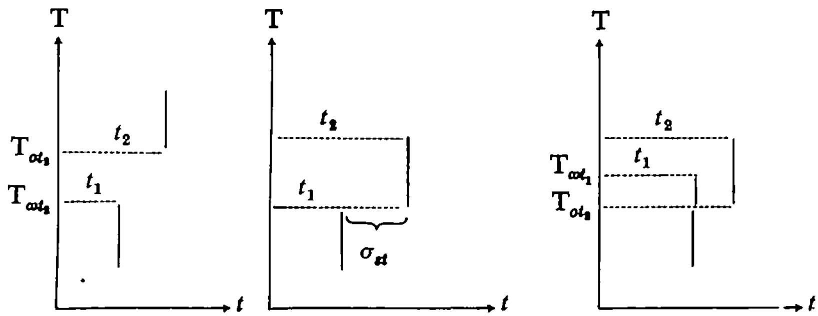


(2.2) There is a certain magnitude σ_{st}, such that,

if $\quad t_2 - t_1 > \sigma_{st}$, then $T_{\omega t_1} <_{\mathrm{M}} T_{\alpha t_2}$;

if $\quad t_2 - t_1 = \sigma_{st}$, then $T_{\omega t_1} = T_{\alpha t_2}$;

and if $\quad t_2 - t_1 < \sigma_{st}$, then $T_{\omega t_1} \in \lambda_{st_2}$ and $T_{oT_2} \in \lambda_{st_1}$.



(1.3) If T_1 and T_2 are different, then μ_{sT_1} and μ_{sT_2} are not identical, and conversely i.e. :

$$T_1 \neq T_2 \rightleftarrows \mu_{sT_1} \neq \mu_{sT_2}$$

(2.3) If t_1 and t_2 are different, then λ_{st_1} and λ_{st_2} are not identical, and conversely : i.e.

$$t_1 \to t_2 \rightleftarrows \lambda_{st_1} \neq \lambda_{st_2}.$$

(1.4) As T_2 approaches T_1 so t_{oT_2} approaches t_{oT_1} ; i.e.

$$\underset{(T_2 - T_1) \to 0}{Lt} \left(t_{oT_2} - t_{oT_1}\right) = 0.$$

(1.41) Similarly $\underset{(T_2 - T_1) \to 0}{Lt} \left(t_{\omega T_2} - t_{\omega T_1}\right) = 0.$

(2.4) As t_2 approaches t_1 so $T_{\alpha t_2}$ approaches $T_{\alpha t_1}$; i.e.

$$\underset{(t_2 - t_1) \to 0}{Lt} \left(T_{\alpha t_2} - T_{\alpha t_1}\right) = 0.$$

(2.41) Similarly for $T_{\omega t_2} - T_{\omega t_1}$.