THE BODY-MIND PROBLEM FROM A PERSONALITY RELATIVITY THEORY APPROACH*

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1. The body-mind problem: a philosophical problem.
2. The Unique Personality Trait Theory (UPTT).
3. The response model.
4. The bridge model.
5. The experimental design.
6. Future ideas of research.

*To Lorenzo Ferrer’s memory, President of the Spanish Society of General Systems

1. The body-mind problem: a philosophical problem

- **Plato**: dualism between sensitive (body) and intelligible (mind) worlds.
- **Descartes**: dualism body-mind connected through the pineal glandule.
- **Popper**: theory of the three emergent worlds.
- **Bunge**: mathematical system approach (related subsystems).
- **Haken**: mathematical approach from lighthouse model of neuron.

2. The Unique Personality Trait Theory (UPTT)

UPTT Postulates-POSTULATE 1

1.1. Existence of a unique trait, the General Factor of Personality (GFP) to describe de overall human personality.

1.2. Possibility to be dynamically measured by the 12 adjectives of the Multiple Affect Adjective Check list (GFP-MAACLR).

1.3. Adjectives: active, adventurous, aggressive, daring, energetic, enthusiastic, merry, mild, quiet, tame, wild and bored.

1.4. Scale of the GFP: [0,60]. From the most extraverts to the most introverts.

2. The Unique Personality Trait Theory (UPTT)

UPTT Postulates-POSTULATE 2

1.1. The GFP has a biological base: the general activation of the stress system (also the brain activation level).

1.2. A low general activation corresponds with a low score in the GFP-MAACLR and with an approach tendency (extraverts).

1.3. A high general activation corresponds with a high score in the GFP-MAACLR and with an avoidance tendency (introverts).

1.4. Existence of a relationship between the GFP and the different biological indicators involved in personality dynamics.

2. The Unique Personality Trait Theory (UPTT)

UPTT Postulates-POSTULATE 3

1.1. The GFP has a dynamic nature. The GFP dynamics is described by the **response model** (**RP**).

1.2. The **RP** has been evaluated experimentally as a consequence of a dose of **caffeine** for the **GFP-MAACLR** dynamics (SJP-2011).

1.3. The **RP** has been has been evaluated experimentally as a consequence of a dose of **methylphenidate** for the **GFP-MAACLR** dynamics (SJP-2012).

1.4. The **RP** has been has been evaluated experimentally as a consequence of a dose of **methylphenidate** for the **c-fos regulator gen** dynamics (SJP-2012).

3. The response model: stimulus dynamics

$$s(t)=\begin{cases}\dfrac{\alpha\cdot M}{\beta-\alpha}\left(\exp(-\alpha\cdot t)-\exp(-\beta\cdot t)\right): & \beta\neq\alpha \\ \alpha\cdot M\cdot t\cdot\exp(-\alpha\cdot t): & \beta=\alpha\end{cases} \qquad (1)$$

s(t): stimulus dynamics (blood concentration of a stimulant drug)

M: drug amount consumed

α: drug absorption rate

β: drug distribution rate

3. The response model

$$\left.\begin{array}{c}\dfrac{dy(t)}{dt} = a(b - y(t)) + \dfrac{p}{b}s(t) - b \cdot q \cdot z(t) \\ y(0) = y_0\end{array}\right\} \quad (2)$$

$$\left.\begin{array}{c}\dfrac{dz(t)}{dt} = -\dfrac{z(t)}{\tau} + s(t) \cdot y(t) \\ z(0) = 0\end{array}\right\} \quad (3)$$

y(t): GFP - Brain activation level dynamics

$a(b - y(t))$ Homeostatic control

$\dfrac{p}{b}s(t)$ Excitation effect

$b \cdot q \cdot z(t)$ Inhibitor effect

3. The response model

$$\left.\begin{aligned} \frac{dy(t)}{dt} &= a(b - y(t)) + \frac{p}{b}s(t) - b \cdot q \cdot z(t) \\ y(0) &= y_0 \end{aligned}\right\} \quad (2)$$

$$\left.\begin{aligned} \frac{dz(t)}{dt} &= -\frac{z(t)}{\tau} + s(t) \cdot y(t) \\ z(0) &= 0 \end{aligned}\right\} \quad (3)$$

y(t): GFP - Brain activation level dynamics

y_0: initial GFP - Brain activation level

b: tonic brain activation level

a: Homeostatic control power

p: Excitation effect power

q: Inhibitor effect power

4. The bridge model.

Hypothesis to obtain the bridge model:
Both GFP and biological indicator hold the response model

$$\left.\begin{array}{c}\frac{dE(t)}{dt} = A\left(B - E(t)\right) + \frac{P}{B}s(t) - B \cdot Q \cdot F(t) \\ E(0) = E_0\end{array}\right\} \qquad (4)$$

$$\left.\begin{array}{c}\frac{dF(t)}{dt} = -\frac{F(t)}{R} + s(t) \cdot E(t) \\ F(0) = 0\end{array}\right\} \qquad (5)$$

E(t): Biological indicator dynamics

4. The bridge model

$$\frac{\partial E}{\partial t}+\left[a\left(b-y(t)\right)+\frac{p}{b}s(t)-q\cdot b\cdot z(t)\right]\frac{\partial E}{\partial y}+\left[-\frac{z(t)}{\tau}+s(t)\cdot y(t)\right]\frac{\partial E}{\partial z}=$$

$$=A\left(B-E(t)\right)+\frac{P}{B}s(t)-Q\cdot B\cdot F(t) \quad (6)$$

$$E(0,y,z)=B-(B-E_0)\left(\frac{b-y}{b-y_0}\right)^{\frac{A}{a}}:y_0\neq b \quad (7)$$

$$\frac{\partial F}{\partial t}+\left[a\left(b-y(t)\right)+\frac{p}{b}s(t)-q\cdot b\cdot z(t)\right]\frac{\partial F}{\partial y}+\left[-\frac{z(t)}{\tau}+s(t)\cdot y(t)\right]\frac{\partial F}{\partial z}=$$

$$=-\frac{F(t)}{R}+s(t)\cdot E(t) \quad (8)$$

$$F(0,y,z)=0 \quad (9)$$

See deduction of (6)-(9) from (2)-(5) in the paper !

5. The experimental design

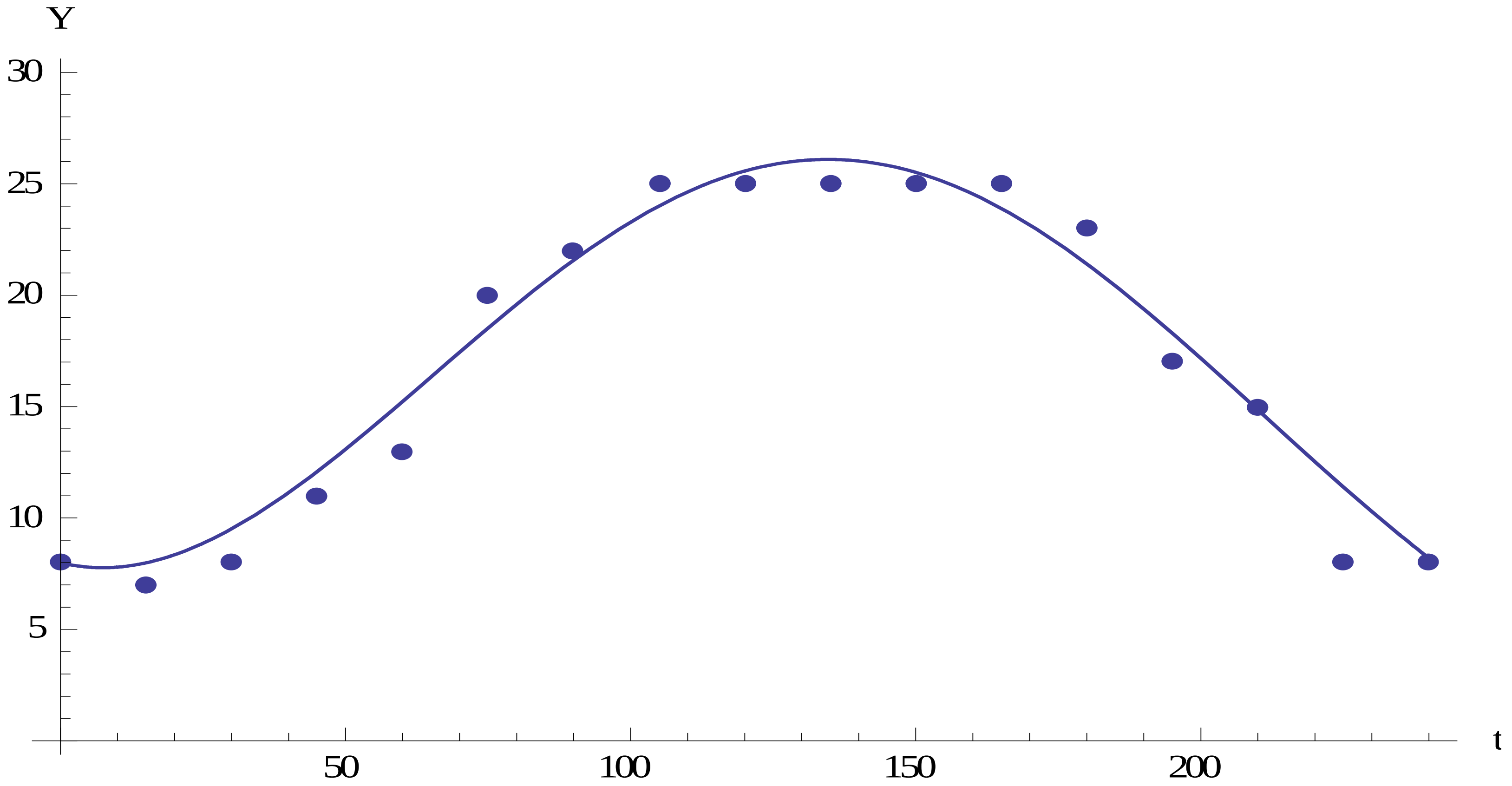
Subject: who is presenting this work. **Period and conditions**: 5 hours in fast conditions. **Phases**:

1. The **12 adjectives** of the GFP-MAACLR and a **sample blood** are obtained for the subject before consumption.
2. A **methylphenidat**e dose of 20 mg is given to the subject.
3. Each 15 minutes the **12 adjectives** are evaluated and each one hour a **sample blood** is obtained.

Results:

1. **17 outcomes** in [0,60] (GFP-MAACLR) each 15 m.
2. **5 outcomes** of **glutamate** blood concentration and **5 outcomes** of **c-fos** blood concentration.

5. The experimental design: validation of the response model (GFP-MAACLR).



GFP-MAACLR scores (points) and **model outcomes** (line) versus time. R^2=0.97

α=0.000069; β=0.006114; a=0.010598; b=1.957947; p=12.235929; q = 0.001514; τ = 490.853858

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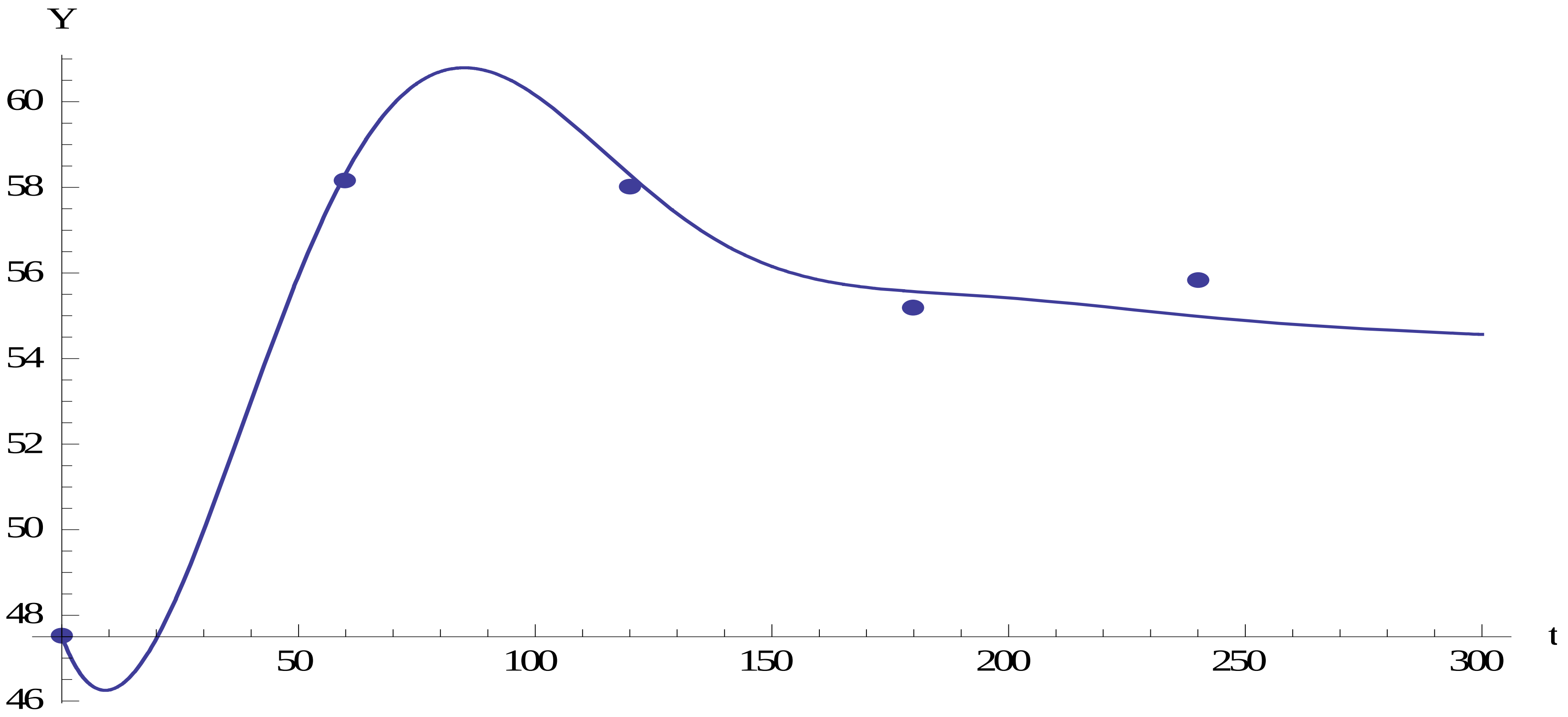
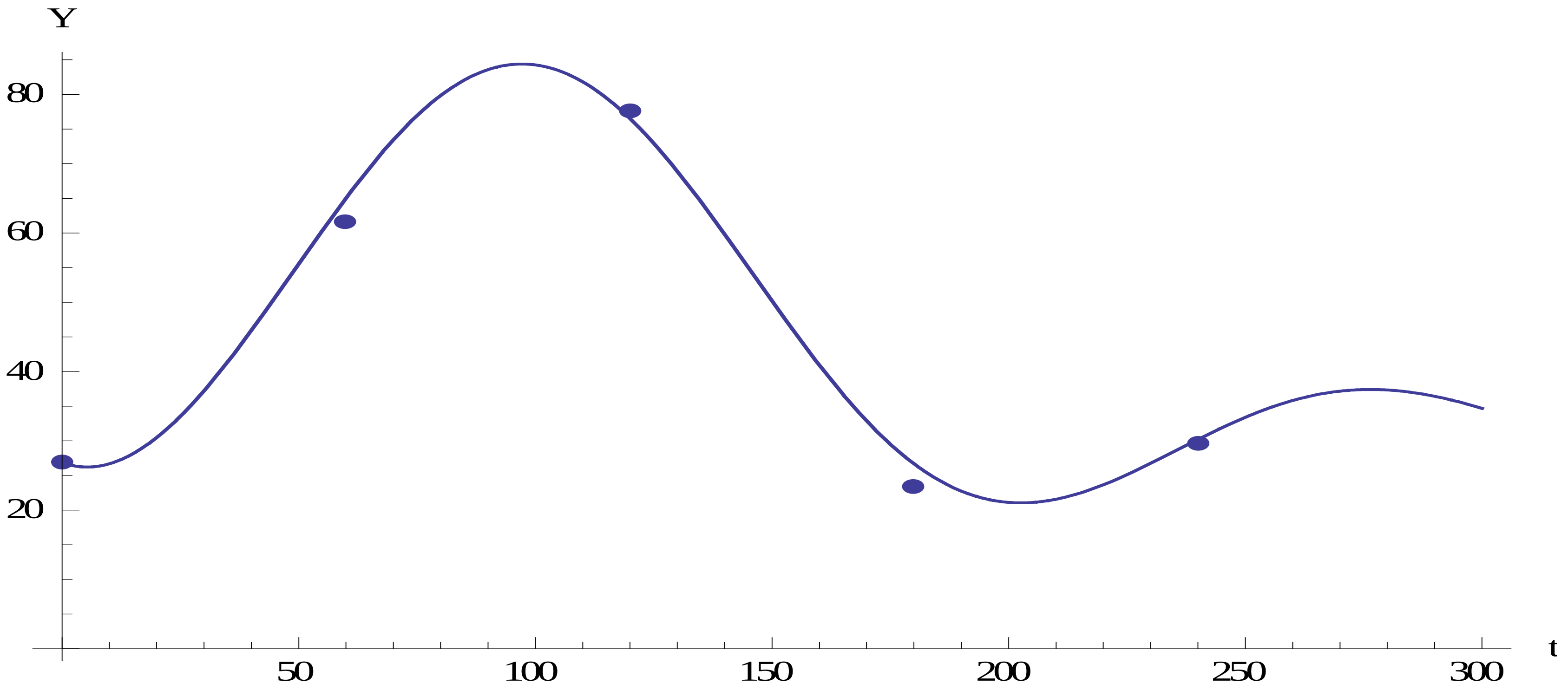
5. The experimental design: validation of the response model (Glutamate).



Glutamate concentrations (points) and **model outcomes** (line) versus time. R^2=0.91

α=0.000069; β=0.006114; A=0.010598; B=19.079219; P=530.003996; Q=0.001257; R=20.190731

5. The experimental design: validation of the response model (c-fos).



C-fos concentrations (points) and **model outcomes** (line) versus time. R^2=0.99

α=0.000069; β=0.006114; A=0.010598; B=3.208015; P=110.515826; Q=0.002774; R=145.089745

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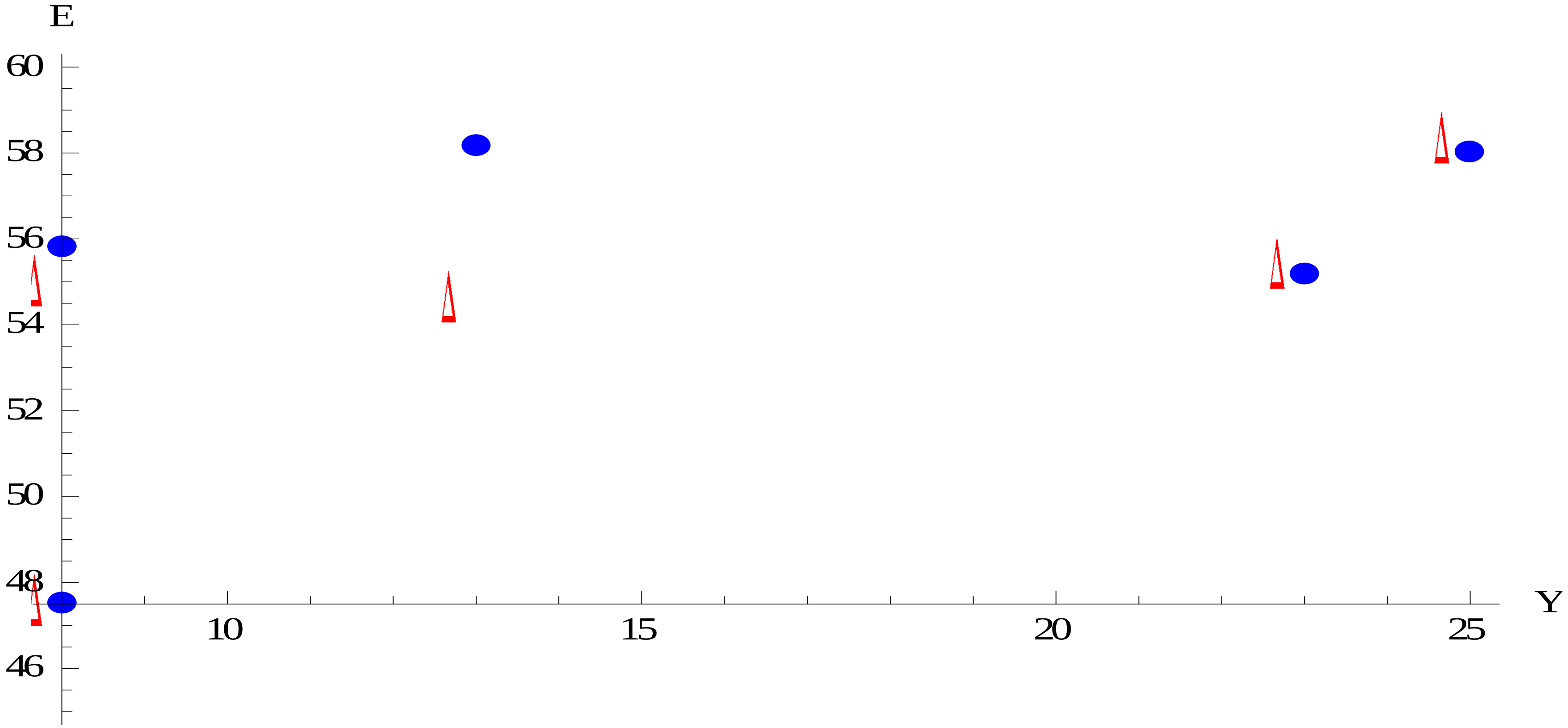
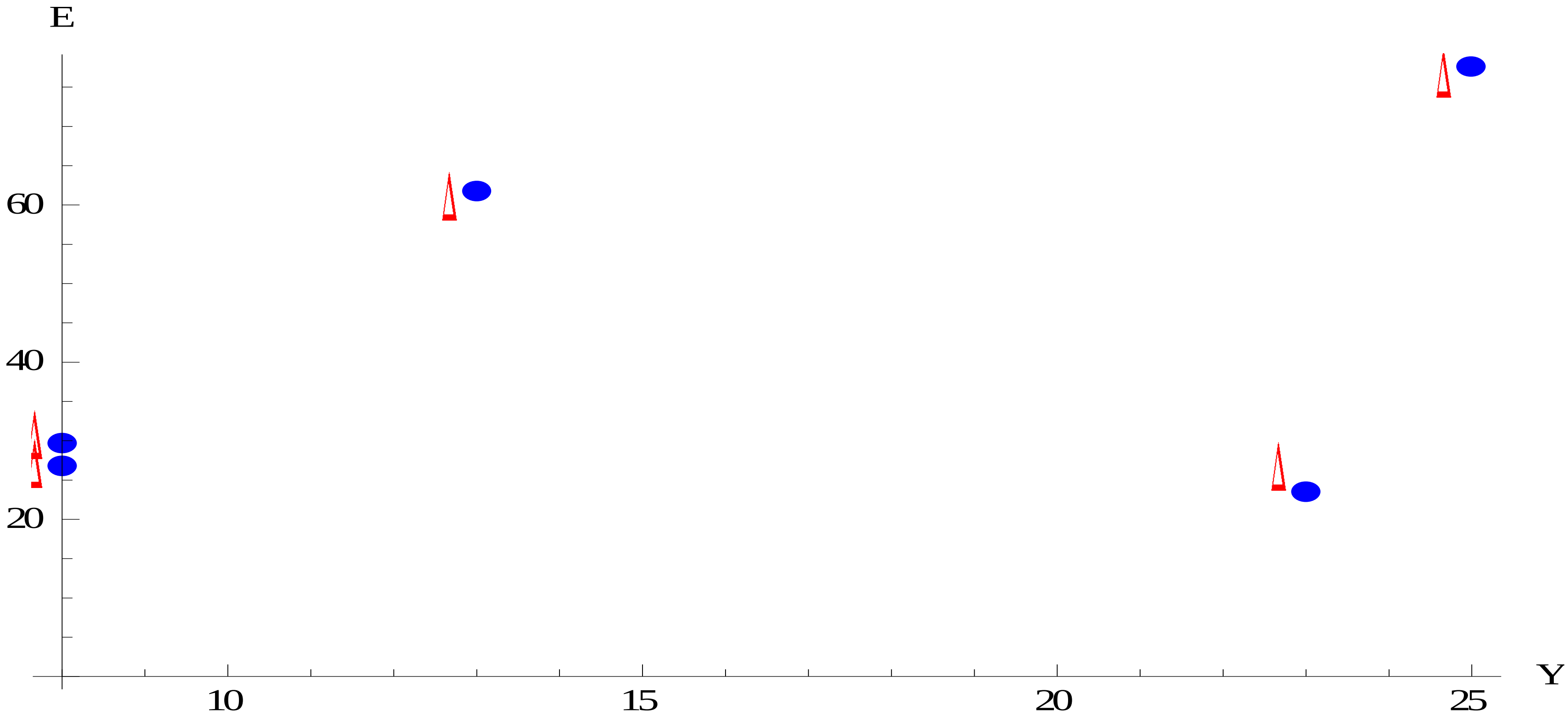
5. The experimental design: validation of the bridge model (Glutamate/ GFP-MAACLR).



Glutamate concentrations in blood (points) and **model outcomes** (triangles) versus experimental **GFP-MAACLR scores**. The relative errors: 0 % (initial condition), 6.2 %, 0.43 %, 0.32 % and 1.52%. R^2=0.14

5. The experimental design: validation of the bridge model (c-fos/ GFP-MAACLR).



C-fos concentrations in blood (points) and **model outcomes** (triangles) versus experimental **GFP-MAACLR scores**. The relative errors: 0 % (initial condition), 0.4 %, 1.4 %, 12.9 % and 3.0 %. R^2=0.99

6. Future ideas of research

1. Researching the bridge between the psychological personality (**mind**) and the overall biological system dynamics (**body**) of personality (including all the relevant biological indicators of personality: glutamate, c-fos, dopamine, serotonin, etc., and their mathematical relationships).

2. Articulating the body-mind problem with the **long-time-term response model** of personality (BJMSP -2010).

3. Approaching the body-mind problem from a **space-time model of brain** obtained from the response model.

4. Approaching the body-mind problem from a **space-time model of brain obtained from the long-time-term response model** of personality (BJMSP -2010).