Founding properties on measurement

Claudio Masolo
Laboratory for Applied Ontology, ISTC-CNR
masolo@loa-cnr.it

Fois 2010 – Toronto, May 11-14.

1 Focus

- How objects can be classified?
- How objects can be (synchronically and diachronically) compared?
- How properties can be ascribed or attributed to objects?

▶ Not an analysis of the ontological nature of properties.

2 Properties ascription as predication

- $\mathsf{1m}(x) \wedge \mathsf{2m}(y) \rightarrow x <_{\mathsf{L}} y$
- $\mathsf{Red}(x) \wedge \mathsf{Orng}(y) \rightarrow x \sim_{\mathsf{C}} y$
- $\mathsf{Red}(x) \wedge \mathsf{Orng}(y) \wedge \mathsf{Blue}(z) \rightarrow \mathsf{Closer}_{\mathsf{C}}(x, y, z)$

3 Properties ascription as having a value

- $\mathsf{Length}(x, 1\mathsf{m}) \wedge \mathsf{Length}(y, 2\mathsf{m}) \wedge 1\mathsf{m} < 2\mathsf{m}$

  $1\mathsf{m}(x) \triangleq \mathsf{Length}(x, 1\mathsf{m})$

  $x <_{\mathsf{L}} y \triangleq \exists l_1, l_2(\mathsf{Length}(x, l_1) \wedge \mathsf{Length}(y, l_2) \wedge l_1 < l_2)$

- $\mathsf{Color}(x, \mathsf{red}) \wedge \mathsf{Color}(y, \mathsf{orng}) \wedge \mathsf{red} \sim \mathsf{orng}$

  $\mathsf{Red}(x) \triangleq \mathsf{Color}(x, \mathsf{red})$

  $x \sim_{\mathsf{C}} y \triangleq \exists c_1, c_2(\mathsf{Color}(x, c_1) \wedge \mathsf{Color}(y, c_2) \wedge c_1 \sim c_2)$

4 A more general framework

- $\mathbf{ob}(o)$: o is an object;
- $\mathbf{tm}(t)$: t is a time;
- $\mathbf{sp_i}(r)$: r is an region in the space $\mathbf{i}$;
- $\mathsf{EX}(o, t)$: the object o **exists** at time t;
- $\mathsf{L}(r, o, t)$: the region r is the **location** of the object o at time t.

Synchronous comparisons:

- $\mathbf{sp_L}(\mathsf{1m}) \wedge \mathbf{sp_L}(\mathsf{2m}) \wedge \mathsf{L}(\mathsf{1m}, o, t) \wedge \mathsf{L}(\mathsf{2m}, o', t) \wedge \mathsf{1m} < \mathsf{2m}$
- $\mathbf{sp_C}(\mathsf{red}) \wedge \mathbf{sp_C}(\mathsf{orng}) \wedge \mathsf{L}(\mathsf{red}, o, t) \wedge \mathsf{L}(\mathsf{orng}, o', t) \wedge$ $\mathsf{red} \sim \mathsf{orng}$
- $\mathbf{sp_{C'}}(\mathsf{red}') \wedge \mathbf{sp_{C'}}(\mathsf{orng}') \wedge \mathsf{L}(\mathsf{red}', o, t) \wedge \mathsf{L}(\mathsf{orng}', o', t) \wedge$ $\mathsf{red}' \not\sim \mathsf{orng}'$

5 Ontological neutrality

- The previous general framework does not commit to a specific (realistic) theory of properties:
  - regions can be seen as *universals* and location as *instance of* (**Universalim**);
  - regions can be seen as *classes of resembling tropes* and location as a combination of *inherence and membership* (**Trope Theory**);
  - regions can be seen as *classes of resembling objects* and location as *membership* (**Resemblance Nominalism**);

- Is it possible to provide a more epistemic interpretation of this general framework?

6 Realism and classification

- Is it necessary to refer to *truth-makers* (what makes possible for an object to be classified in a particular way) to classify and compare objects in a **communicable** and **inter-subjective** way?
- Without truth-makers is it necessary to embrace *conventionalism*: 'ontological' properties do not exist, they are created by conventions?

7 Properties and measurement

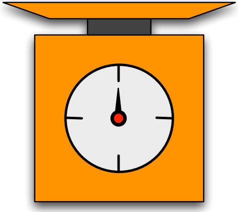
- **Hypothesis**: an object is classified as ‘1m long’ (one ascribes to it the property of ‘being 1m long’) if and only if the result of its length measurement is **1m**.

- Roughly:
  - spaces are related to measurement instruments;
  - regions in a space correspond to the values of a measurement instrument related to this space;
  - the location relation corresponds to the result of the measurement of an object by means of this instrument.

8 Towards an empirical theory of measurement

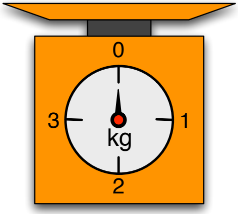
- I consider an alternative to the *Representational Measurement Theory* that takes into account the epistemic/empirical aspect of measurement.
- I extend the theory introduced by Frigerio, Giordani, and Mari by
  - providing a formal account of the *measurement standards* and of the *calibration* process and
  - considering time and *diachronic* comparisons.

9 Measurement system: support



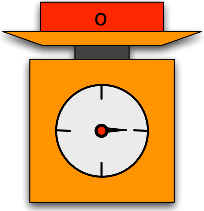
- m is the (physical) **support**
  - m is the balance in this case;
- $\mathcal{E} = \langle U, R_1, \ldots, R_n \rangle$ is the **empirical structure**: the set of empirically discernible internal states of m (after any possible interaction with an object) and the relations between them
  - U is the set of 4 states $\{s_0, s_1, s_2, s_3\}$ that correspond to any alignment between the indicator and one notch (discrete balance);
  - R is the order established (in U) by the clockwise order of notches: $s_0 \prec s_1 \prec s_2 \prec s_3$

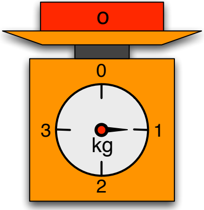
10 Measurement system: symbolization



- $\mathcal{S} = \langle V, S_1, \ldots, S_n \rangle$ is the **symbolic structure** necessary for abstracting from and refer to the internal states of the support m
  - $V = \{0\text{kg}, 1\text{kg}, 2\text{kg}, 3\text{kg}\}$
  - S: $0\text{kg} < 1\text{kg} < 2\text{kg} < 3\text{kg}$
- λ: $U \rightarrow V$ is the **symbolization function**
  - $\lambda(s_n) = n\text{kg}$
  - $n\text{kg} < m\text{kg}$ iff $s_n \prec s_m$

11 Measurement system: interaction





- κ: $O \to U$ is the **interaction function** that associates to an object $o \in O$ the internal state of the complex system $m \bullet o$
  - $\kappa(o) = s_1$, then
  - $\lambda(\kappa(o)) = 1\text{kg}$

it describes as the support interacts with the environment.

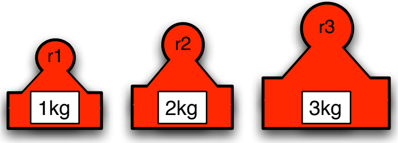
12 Difference with respect to RMT

- **Representational Measurement Theory** conceives measurement as the building of a homomorphism from an *empirical structure* $\mathcal{O} = \langle O, R_1^O, \ldots, R_n^O \rangle$ to a *numerical* structure $\mathcal{S} = \langle V, S_1, \ldots, S_n \rangle$.
- In the empirical measurement theory, it is the structure of the support that *induces* (via an interaction process) a structure on objects:
  - U gives the *resolution* of the MS
    $o \approx o'$ iff $\kappa(o) = \kappa(o')$
  - each R_i induces a relation on objects
    $R_i^O(o_1, \ldots, o_n)$ iff $R_i(\kappa(o_1), \ldots, \kappa(o_n))$

  i.e. an MS (and the measurement procedure) provides a specific 'point of view' on reality.

13 Measurement standard (mST)

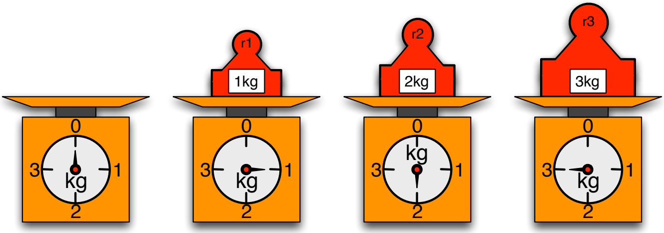
- a set R of *reference objects*: $\{r_0, r_1, r_2, r_3\}$;
  (in the example we have the problem of the 'null object' r_0)
- a *symbolic structure* $\mathcal{R} = \langle M, S_1^M, \dots, S_n^M \rangle$;
  - $M = \{\text{0kg}, \text{1kg}, \text{2kg}, \text{3kg}\}$;
  - $\text{0kg} < \text{1kg} < \text{2kg} < \text{3kg}$;
- α: $R \to M$ is a one-to-one function that conventionally assigns to each object in R a symbol in M: $\alpha(r_n) = n\text{kg}$



14 Calibration

MS $\langle m, \mathcal{E}, \kappa, \mathcal{S}, \lambda \rangle$ is calibrated w.r.t mST $\langle R, \mathcal{R}, \alpha \rangle$ iff:

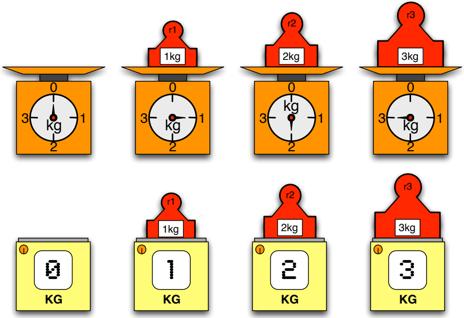
- $\mathcal{S} = \mathcal{R}$ (or more generally, there is a one-to-one relation between $\mathcal{S}$ and $\mathcal{R}$, i.e. the MS resolves the reference objects of the mST);
- for each $r, r_1, \ldots, r_n \in R$
  - $\lambda(\kappa(r)) = \alpha(r)$ and
  - $S_i(\lambda(\kappa(r_1)), \ldots, \lambda(\kappa(r_n)))$ iff $S_i^M(\alpha(r_1), \ldots, \alpha(r_n))$



15 Measurement framework

- A **measurement framework** is a couple $\langle \mathsf{s}, M^* \rangle$ where s is an mST, and M^* is a set of MSs calibrated with respect to s.

▶ Abstract from the physical implementation/relatization of the MSs

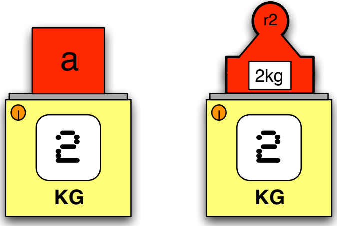


16 a has P

- Given an mST s with symbolic structure $\langle M, S_1^M, \ldots, S_n^M \rangle$, it is possible to **associate** to each $s_p \in M$ a property P:

  'a has P' if and only if there exists an MS $\langle m, \mathcal{E}, \kappa, \mathcal{S}, \lambda \rangle$ calibrated with respect to s such that $\lambda(\kappa(a)) = s_p$

- e.g. a has the property of 'being 2kg heavy' iff $\lambda(\kappa(a)) = 2$kg:

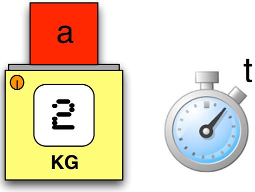


17 a has P at t

- Given an mST s with symbolic structure $\langle M, S_1^M, \ldots, S_n^M \rangle$, it is possible to **associate** to each $s_p \in M$ a property P:

  'a has P at t' if and only if there exists an MS $\langle m, \mathcal{E}, \kappa, \mathcal{S}, \lambda \rangle$ calibrated (at t) w.r.t. s such that $[t](\lambda(\kappa(a)) = s_p)$ (that represents the fact that m and a interacted at t with the result s_p).

- at t a has the property of 'being 2kg heavy' iff $[t](\lambda(\kappa(a)) = 2\text{kg})$:



18 Measurement structure

A measurement structure, is a structure $\langle O, T, S, F, EX \rangle$ where:

- O is a set of 'objects'
- T is a set of 'times'
- S is a set of 'symbols'
- F is a set of *measurement frameworks*
- $EX \subseteq O \times T$

19 The general framework in terms of MSs

Given the measurement structure $\langle O, T, S, F, EX \rangle$:

Objects	$\mathbf{ob}^{\mathcal{I}} \subseteq O$
Times	$\mathbf{tm}^{\mathcal{I}} \subseteq T$
Regions of space i	$\mathbf{sp_i}^{\mathcal{I}} \subseteq M_i$ (the set of symbols of the mST s_i in an MF of F)
Existence in time	$\mathsf{EX}^{\mathcal{I}} \subseteq EX$
Location	$\mathsf{L}^{\mathcal{I}} \subseteq S \times O \times T$ and $\langle r, o, t \rangle \in \mathsf{L}^{\mathcal{I}}$ iff there exists an MS $\langle m, \mathcal{E}, \kappa, \mathcal{S}, \lambda \rangle$ belonging to some M_i^* (in one measurement framework) such that $[t](\lambda(\kappa(o)) = r)$

20 Remark: intensionality

- Properties that are *associated* to non-aligned MSs can be ascribed to the same objects, i.e. the ascription is not *extensional*. The *intension* is grounded on the MSs, on the mSTs, and one the measurement/calibration procedures.

21 Remark: ascription as measurement

- $\mathsf{EX}(o, t') \wedge \mathsf{L}(r, o, t) \wedge \mathbf{sp}_i(r) \rightarrow \exists r'(\mathsf{L}(r', o, t') \wedge \mathbf{sp}_i(r'))$
  if, at a given time t, an object o is located in a specific space $\mathbf{sp}_i$, then it is located in $\mathbf{sp}_i$ at every time at which o exists.

- Seems ontologically but not empirically plausible: the fact that o has been measured at t does not imply that o has been measured (w.r.t. the same dimension $\mathbf{sp}_i$) at every time at which it exists.

- The ascription of a property to an object relies on the measurement of this object.

- It is possible to introduce a potential aspect, i.e. if measured an object would produce a specific result, but this seems to require the difficult notion of *disposition*.

22 Measurement and realism again (a)

- Objects that interact with the support providing the same result ($\kappa(o) = \kappa(o')$) can, but do not necessarily need to, share an *ontological* property.
  - In particular an MS with a coarse resolution is unable to distinguish some ontological properties.
  - The same for relations $R_i(\kappa(o_1), \ldots, \kappa(o_n))$.
- On the other side, the states induced in the MS depend on the ontological properties of the objects.

23 Measurement and realism again (b)

- Measurement enables classifications and comparisons of objects without making powerful assumptions about their conformity with ontological properties.
- Calibration and symbolization assure *communicability* and *inter-subjectivity*.
- MSs are **builded** because the classifications and the comparisons they provide allow us for (environmentally useful) **predictions**.

24 Change of mSTs and MSs

- **mSTs can change across time**
  A property is associated to a symbol of an mST that identifies a reference object. The diachronic alignment of the MSs relies on the calibration, at different times, w.r.t. **the same** mST. The change of reference objects of an mST invalidates the alignment.

- **MSs can change across time**
  Interaction and symbolization functions depend on the structure of the support m that can change across time. By (diachronically) calibrating an MS m w.r.t a stable mST s one assures the stability of m. Even assuming instantaneous measurement: (i) MSs are not re-calibrated every time they are used, and (ii) calibration and measurement cannot be synchronous.

25 Stable frameworks of objects

- If mSTs and MSs are **assumed** to be stable (at least from the calibration to the measurement), the state of $m \bullet a$ and the one of $m \bullet b$ depend exclusively on how a and b are.

- Only by assuming the stability of a framework of objects (mST and MSs) one can conclude that a and b *share* a property, that a *similarity* between them exists.

- Instead of re-identifying objects on the basis of a stable framework of properties, here we are 're-identifying properties' on the basis of a stable framework of objects.

26 Circularity

- **But** to empirically justify the stability of mSTs and MSs one needs to diachronically compare the supports and reference objects.
- To do that other mSTs and MSs, the stability of which, in turn, needs to be justified.

  Circularity!
- One can consider the *global framework* of all mSTs and MSs, the stability of which is determined on the basis of the **mutual relationships** between the components.
- This does not detect absolute change that maintain the mutual relationships.

27 Sensory properties

- The previous general framework can be also used to represent cognitive or sensory properties e.g. colors, flavours, textures, etc.
- How senses classify **distal stimuli**?
- Is it possible to establish some connection between **sensory classification** and (empirical) measurement?

▶ There exists a particular huge literature on **colors**.

28 Realism and sensory properties

- "[C]lassification enables us to investigate the activity of sensory systems without making powerful assumptions about their conformity with external kinds.
- Are distal stimuli classed together because they share some physical property?
- Or on the basis of some environmentally useful response that they evoke in sensory systems?" (Matthen 2005, p18)

29 Matthen's 3 stages sensory process (a)

- "When a perceiver S looks at a wooden tabletop, she is in visual state B. In virtue of being in this visual state B the thing that S has in view looks a certain colour, say *brown*. S uses this colour-look, her own measuring state, to designate an object-property of the object at which she is looking." (Matthen 2005)
- "To say that something is yellow is to say that it has the color denoted by the experience we recognize as of the yellow type" (Matthen 2010)

30 Matthen's 3 stages sensory process (b)

- **Stimuli**: material objects and the packets of energy that they send to our sensory receptors.
  - Similar to objects in MSs
- **Sensory classes**: the groups that the system makes of the stimuli, and sense-features, the properties that stimuli in a given sensory class share in virtue of belonging to that class.
  - Similar to internal states in MSs
- **Sensations**: events in sensory consciousness with a particular subjective 'feel'. These events are like labels that the system attaches to stimuli in order that we may know that they have been assigned to a particular class.
  - Similar to symbols in MSs

31 Sensory Signalling Thesis

- **Sensory Signalling Thesis**. A sensory experience is a *signal* issued in accordance with an internal convention. It means that the sensory system has assigned a stimulus to a certain category–the same category as when other tokens of the same signal are issue.
  - Things are not classified as red because they look red (under normal circumstances); instead, they look red because the visual system has determined that they are so.
- **Sensory Ordering Thesis**. Sensory systems create *ordered* relations of similarity and dissimilarity among stimuli, relations which grade the degree of similarity that one sensed object bears to another.
  - Similar to relations in MSs

32 Sensory systems: interaction (a)

- The ‘interaction’ function from *stimuli* to *sensory classes* is encapsulated in the physical structure of the sensory apparatus.

- Sensory systems are the result of an evolutionary process that designs them in a way useful for the acting and survival of a given species in the environment: “one Darwin’s important discoveries is that we can think of design without a designer” (P. Kitcher, 1993).

- Sensory systems could produce similar outputs for very different (distal-) stimuli or very different outputs for similar stimuli: the classification is useful for the acting and survival of the species and in general we don’t know which ontological properties sensory systems capture.

33 Sensory systems: interaction (b)

- "S [a system] has the function of indicating the F [a property] of those objects which stand in C [contextual relation] to it, but it does not have the job of indicating–does not therefore represent–which objects–or even whether there is an object–that stands in C to it." (Dretske 1997, p26)

- "That S represents k, therefore, implies a representational fact–that, for some F, S represents the F of k. But it also implies something that is not a representational fact–viz., that k stands in relation C to S. [*hybrid facts*]" (Dretske 1997, p26)
  - The interaction functions seems to represent the non representational fact, it is a fact about the representation.

34 Sensory systems: symbolization

- The ‘symbolization’ function from *sensory classes* to *sensations* is also encapsulated in the physical structure of the sensory apparatus (of a specific subject) but presupposes consciousness.

- The ‘symbolization’ function too can be seen as the result of an evolutionary process.

- “[T]he internal states the sense produce by way of performing their function have original intentionality, something they represent, say, or mean, that they do not get from us. That is why the perceptual representations in biological systems (...) make the systems in which they occur *conscious of* the objects they represent” (Dretske 1997, p8)

35 Auto-calibration

How the symbolization function can be stablished?

- Suppose to find an instrument without any symbol on it.
- Suppose to know how the instrument can interact with the environment and to discern its internal states.
- Suppose to write symbols in correspondence of internal states.
- Then, assuming the stability of the instrument, one can **compare** and **classify** objects.
- Without undertanding what she is measuring, she can observe that objects of kind A are 'good' while objects of kind B are 'bad'.
- Then, one starts to do some predictions on the environment.

36 A note on consciousness

- **Phenomenal vs. conceptual awareness**: an *experience* of color is, in general, assumed as different from a *belief* about color.
  - "One can be phenomenally conscious of a shirt's color (...) without being conscious that anything is blue". (Dretske 1997, p12)
- **Parallel with instruments**. Two speedometers that have the same 'experience' (viz. of an axle rotation of N rpm) could give rise to different 'beliefs' (about speed, because the diameter of the wheels to which they are connected differs).
- "Through learning, I can change what I believe when I see k, but I can't much change the way k looks (phenomenally) to me, the kind of visual experience k produces in me (...) We can, through learning, change our calibration" (Dretske 1997, p15).

37 Inter- and intra- species calibration

- Are sensations stable across different individuals of the same species?
- How languages help in communication of sensations?
- Different species have different visual systems, therefore the fact that there is or there is not a correspondence between human colours and dog colours is an empirical question.
- **Action-relative realism** "Dog colours are adequate for dog activities, human colours for human activities" (Matthen 2005, p.206)
- How much the way cognitive systems 'chunk' reality into useful parcels (*categorization*), is encoded in the physical support (phenomenal level) or depends on a learning process (conceptual level)?

END

38 Quali sono le differenze? come devo modificare la mia teoria della misura?

- lo strumento c'e' gia', ognuno di noi ne ha uno diverso che e' stato evolutivamente "progettatto",
- individui della stessa specie hanno strumenti strutturalmente molto simili, mentre specie diverse possono avere strumenti diversi (quindi secondo la teoria della mis prima descritta i colori umani sono diversi da quelli piccioneschi)
- visto che questi strumenti sono gia' cablati in noi e quindi in pratica non ho nessuna teoria che dia senso/significato alle misure, allora come faccio io a dare senso ai colori? (auto calibration)
- come faccio a comunicare i colori con altre persone? come faccio a

raggiungere la inter-soggettivita'? (qui introdurrei le vari posizioni filosofiche rispetto ai colori)

- capicita' di selezione ed indipendenza molto piu' limitate, ad es. i colori percepiti dipendono molto dalle condizioni di luce ambientali
- **gli apparati sensorial in termini evolutivi possono essere evoluti in mettere assieme certe proprieta' ontologiche anche disparate in quanto queste sono equivalenti dal punto di vista delle necessita' interattive di una certa specie**

39 Color attribution

- **Attribution relativism**. "I claim not that the property *red* is relativized to standard perceivers and standard viewing conditions, but that ordinary color attributions are tacitly relativized to standard perceivers and standard viewing conditions" (Cohen 2004, p.476)
- **Physical specificability** "Categories posited by perceptual states (...) can be *physically specified*: for the break between *orange* and *red* to be even a candidate for reality, we should be able to say in terms of physics where the break occurs" (Matthen 2005, p.204)
- **Action-relative realism** "Dog colours are adequate for dog activities, human colours for human activities" (Matthen 2005, p.206)

40 Colors vs. shapes, size....

da mettere alla fine Color experience specifies the world in terms of categories like yellow and red and the relations between them. These categories result from visual processing, specifically opponent processing; they are not (as the phenomenon of metamerism shows) physically unified categories; they are physically definable, but only by bringing in systemic idiosyncrasies like cone-cell tuning and opponent processing. By contrast, properties like shape, size, and motion are categories of physics; here there is a much closer correspondence between representational content and definable physical properties that are system-independent. This is the truth that the visual scientists, quoted in section 1 of the target article, are after, though they mis- state the point. (It is perhaps clearer in Galileo, Descartes, and Locke.) The important point to fasten upon is not that things look colored because the signal emanating from them has been processed by the visual system. All visual appearance results from visual processing; this does not distinguish color from anything else. The important point is that color categories and their inter-relationships result from visual processing. It is these idiosyncratically manufactured categories that figure in representational content.

41 Realism again

- The relationship between measuring states and object-properties (...) is semantic in exactly the same sense as demonstrated in the case of colour-vision in the last section. That is, given that the instrument is in a particular state, the thing it is measuring appears, as far as the instrument goes, a certain way. The calibrated notation on the face of the gauge gives us a way of expressing this property. (Matthen, p259)

- supponiamo di trovare uno strumento in cui non ci sia nessun simbolo e nessuna scala (oppure se ci sono questi non hanno nessun significato per me, magari sono simboli marziani). Allora come faccio a capire che cosa misura questo strumento? (quindi come facciamo a capire qual'e' la funzione dello strumento)

- se so che e' una bilancia, allora anche se non e' disegnata la scala, posso pero' prendere un mST per il peso e tararlo rispetto a questo, quindi riscrivere la scala su di lui.... se invece non so la sua funzione, non so che serve per misurare il peso, allora non posso fare niente....

- supponendo di sapere come usare lo strumento (cosa non scontata) posso mettere io dei simboli che corrispondono a degli stati interni in modo da rendere piu' espliciti i risultati della misura

- a questo punto, anche se non ho nessuna idea di che cosa sto misurando, se suppongo che lo strumento e' stabile nel tempo, posso allora confrontare tra di loro degli oggetti (**auto calibration** vedi p261 Matthen)

- anzi, se poi seleziono un mST posso anche comunicare con gli altri le misure e fare in modo di costruire dei measurement frameworks anche se continuo a non sapere che cosa sto misurando

- allora come faccio a dare del senso a questi segni che ho scritto sul mio strumento? e' proprio il fatto di poter confrontare tra loro oggetti diversi o rimisurare lo stesso oggetto a tempi diversi che mi permette di capire delle regolarita': ad esempio se osservo che oggetti che il mio strumento misura con A riesco a caricarli sulla mia bici senza romperla, allora A comincia ad assumere un certo significato per me.... (quindi sto usando induction and generalization)

- When a perceiver S looks at a wooden tabletop, she is in visual state B [che corrisponde quindi allo stato interno di un MS dovuto all'interazione tra S (o il sistema visivo di S) e il tabletop]. In virtue of being in this visual state B the thing that S has in view looks a certain colour, say *brown* [che quindi corrisponde al simbolo associato allo stato in un MS]. S uses this colour-look, her own measuring state, to designate an object-property of the object at which she is looking

- Problems with the selectivity of the systems, our visual system is not able to cut off light that can change colors.... MA vedi libro di Matthen in cui io posso imparare a sapere come certe luci cambiano i colori (colour-properties) sulla base del fatto che certe proprieta' di solito vanno assieme ad altre o sulla base di esperienze diverse

DOVE STA PERO' L'APPRENDIMENTO? STA AL LIVELLO DI λ O STA AD UN LIVELLO PIU' ALTO? QUESTO NON MI E' MOLTO CHIARO