The measure and mismeasure of creativity

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Creativity: A 21\textsuperscript{st} century competency

- 2010 IBM international study of CEOs (N=1541)
  - Creativity is the top ability sought after for top management

- 2013 Adobe survey, 4000 grade 1--12 teachers and parents, (USA, UK, Germany, Australia)
  - 85 to 90\% of parents, 65 to 87 \% of teachers: «Creativity is essential for the future economy»

- 2015-2016 OECD – International study on educating creativity

- 2016 World Economic Forum “Future of jobs report”- Creativity will be one of the top three capacities for employability in 2020.
Creativity is a capacity to produce content that is both novel and valuable within its' context.
Why should we measure creativity?

1. Measures operationalize a psychological construct, allowing it to be captured, and discussed.

2. Measures facilitate a capacity being valued in the educational system.

3. Measures contribute to detection (selection, orientation) and capacity development.
Levels of creative activity

- Mini c - intra individual
- Little c – interpersonal, local context
- Pro C – domain context
- Big C – global context
Multivariate approach

Cognitive factors
- Specific abilities
- Knowledge

Conative factors
- Specific traits
- Motivation

Affective factors
- Emotion traits
- Emotion states

Environment
- Culture

Creative potential according to the domain

Creative process

Creative Production (achievement - talent)
Creative Process

- A two mode process is assessed
  - Divergent-exploratory: generate many original ideas
  - Convergent-integrative: generate one elaborated idea that combines several elements in a new way
Divergent thinking
The Divergent-Exploratory Mode of thinking

- A set of internal factors are relevant:
  - Cognition: Selective encoding, Flexibility, Knowledge,
  - Personality: Perseverance, Openness, Non-conformity
  - Motivation: Novelty-seeking
  - Emotion: Positive emotion
Convergent thinking
The Convergent- Integrative Mode of thinking

A set of internal factors are relevant:

- Cognition: Selective comparison (analogies, metaphors), selective combination (bisociation, janusian thinking, ...), evaluation
- Personality: Perseverance, Non-conformity, risk taking, Ambiguity tolerance,
- Motivation: Need for Achievement, Need for Order
- Emotion: Negative emotion
Assessment Issues

1. Creative Potential vs. Creative Achievement (Talent)
2. Domain-specific vs. general
3. Measurement approach to potential
   - Simulate real creative work (art, literary composition, ...)
   - Involve divergent-exploratory, convergent-integrative thinking, involve motivation, personality factors, emotions
Examples of creativity measures

- TTCT : Divergent, graphic and verbal
- WKCT : Divergent, verbal
- RAT : Convergent, verbal
- TCT-DP : Convergent, Graphic
Examples of Measures

- RAT (Mednick)

**surprise – birthday – line**

*(response: party)*
de char l'éléphant
Table 1
Results of factor analyses (factor loadings) of TCT-DP subscores after varimax rotation.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Drawing form A</th>
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<td>24%</td>
<td>29%</td>
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$Cn = $ Number of graphic elements used among the initial elements proposed; $Cm = $ Number of graphic elements used in a meaningful way; $Ne = $ Number of new items added to the composition; $Ci = $ Number of contacts established between the initial graphic elements; $Cth = $ Degree to which the elements were connected thematically; $Bfd = $ Use of the element outside the frame; $Bfi = $ Use of added elements outside the frame; $Pe = $ Use of three-dimensional drawing techniques; $Hu = $ Creation of a humoristic or emotional atmosphere; $Uct = $ Use of unconventional, non-stereotyped content or graphic forms. Expl. Var. = Explained variance; Pct. Var. = percentage of explained variance.
EPoC, a new battery to evaluate creative potential

• Developed from 2000 – 2010, based on prior research on children’s development of creative thinking.

• 2011: Artistic-graphic and Literary-Verbal domains normed on a French population.

• 2013: Versions in English, Arabic, German, Turkish (and other languages under development – Polish, Chinese, Portuguese, Slovenian, ...).

• 2015: Extension to Social, Math, Science, Music Domains & OECD research use in 10 countries.
How does EPoC work?

- Have the child show what they can produce when they engage the creative process in a domain-specific, meaningful task.

- Solicit both divergent-exploratory and convergent-integrative thinking, the two main parts of the creative process.

- Measure children’s creative thinking on two separate occasions, with two distinct contents from the target domain.
Test Administration

- Individual
- 2 sessions of 20 minutes per domain assessed, several days apart
- Each session, divergent-exploratory and convergent-integrative tasks

Scoring =
- Divergent : Fluency
- Convergent : judges ratings
Examples of productions Divergent-exploratory
Examples of productions
Convergent - Integrative
EPoC Scoring

Divergent-exploratory: fluency

Convergent-integrative: original synthesis
Why fluency?

Make as many drawings as you can with the given graphic form.

Try to be imaginative.
Profile of statistical originality

Rank in the sequence
Profil de l'originalité statistique

Rang dans la séquence
Mean originality as a function of rank in the sequence
(N = 197)

Mouchiroud & Lubart (2003)
### EPoC Scoring: overview

#### Intervalle de confiance (seuil 90 et 95%) autour des valeurs de quotients

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<th>IF 95%</th>
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#### Efficience

Interprétation de l’efficience, chapitre 4, p. 99 à 99

7. Report des quotients entourés de leur IF

#### Synthèse efficience

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EPoC Scoring: overview
EPoC : Construct validity

CFA consistent with the theoretical model
### EPoC : Relation to Intelligence

Sample: N = 79: 46 girls and 33 boys, 7 to 8 years old, in second grade

#### Criterion: WISC-4

<table>
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Additional EPoC Domains

Graphic-Artistic: Abstract and Concrete
Verbal-literary: Titles and Characters
Science: Natural and Human sciences
Social: Peers and Others, Dyad and Group
Math: Numbers and Figures
Musical: Instruments and Objects
Corporal-Kinesthetic: Individual and Collective
Ajout d'un nouveau bouton pour enregistrement
Before you begin the real task, play with this special calculator.

Try to get 7. Alerts will tell you when you do something not allowed:

- divisions must give only whole numbers, no fractions
- subtract only small numbers from bigger ones
- and use at least 3 different numbers and 2 operations (they light up when used).

Hit OK when green, to record your calculation. The arrow goes back in a calculation.

Click below to go on.
Numbers: Convergent thinking

Before you begin the real task, play with this special calculator.

Try to get 1.
Alerts will tell you when you do something not allowed:
divisions must give only whole numbers, no fractions
subtract only small numbers from bigger ones
and use all 9 numbers and 2 operations at least once
(they will light up when used).
The arrow goes back in a calculation.

Click below to go on.
Examples of low and high responses for the “Numbers” divergent task

• Fluency (number of calculations produced in 10’)
  – Mean: 13.5
  – Standard deviation: 8.7
  – Minimum: 1
  – Maximum: 54

• Originality
  – Low (High frequency): $5 + 4 - 1 = 8$
  – High (Frequency ≤ 1%): $(2 + 6) \times 2 - 8 = 8$
Uses of EPoC

*Education*: used to pre test, and post test children and adolescent to see effects of educational training

*Education*: used as a screening tool for entry into some schools, or programs (“creative gifted”); used to detect children's profiles and guide differentiated educational activities based creative domain abilities

*Clinical*: used as part of psychological testing, complementary to IQ tests, to provide a better vision of a child as a whole
Results - Creativity training study

![Bar chart showing EPoC scores pre and post for Control DE, Exp DE, Control CI, and Exp CI tasks and conditions.]
Summary of the main points

- Creativity: involves multiple psychological factors, and two processes

- Evaluation: a new measurement technology, EPoC: theoretically grounded – domain-situated approach, easy to administer and score

- Creative potential can be measured and developed
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