NON MONETARY EVALUATION METHODS

1) To accept (physical and social) complexity
2) Policy tools: those that accept complexity

E.G. social multicriteria decision aid,
SocialMulticriteriaEvaluation (G. Munda - UAB)

What is most important:
QUALITY of the evaluation process

Complexity

- Different NON-EQUIVALENT description of
- NESTED hyerarchical systems
- Different time-space scales

What seems to go at one scale is bad at the other:
e.g. paying taxes, good at the individual scal, bad at the macro-scale

Which are the boundaries of what the researcher want to observe?
→NON-NEUTRALITY OF SCIENCE

Social complexity: different point of view of actors and stakeholders

COMPLEXITY

COMPLEX SYSTEMS

CANNOT BE CAPTURED

BY A SINGLE

DIMENSION/PERSPECTIVE

Mario Giampietro (UAB)

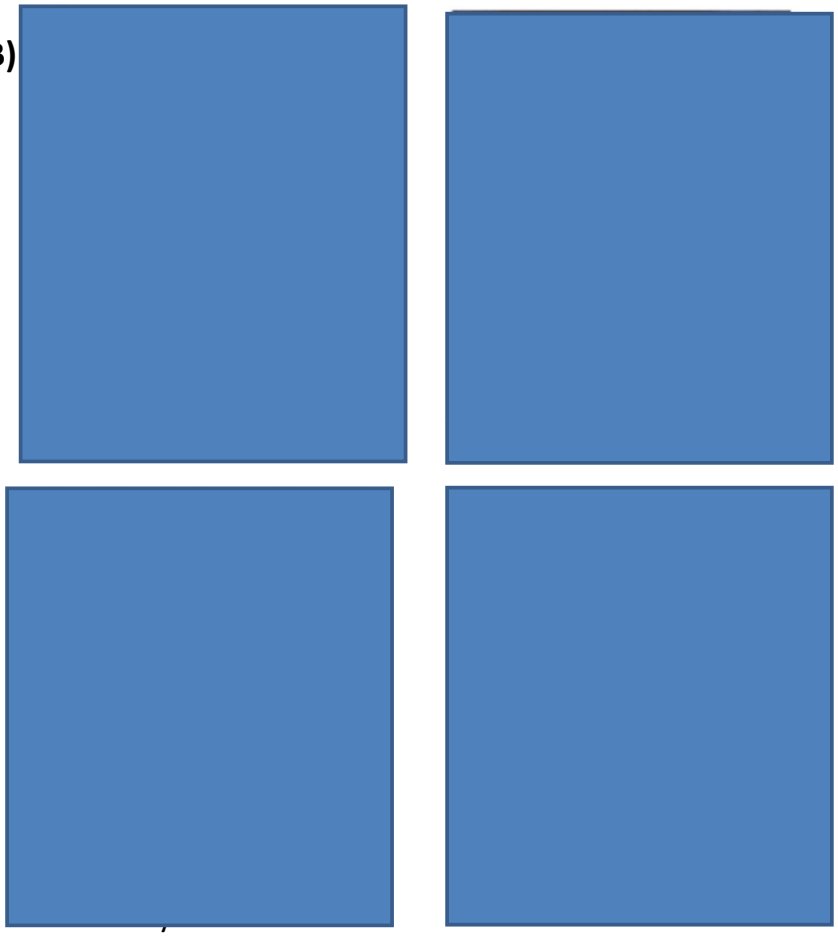
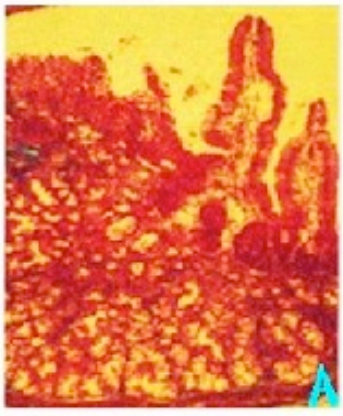


Fig. 1.2

Non-equivalent views of the same person

TRUE PICTURE of this lady?



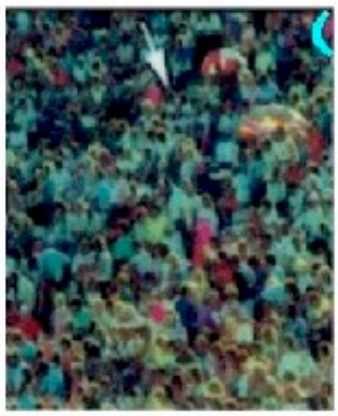


Fig. 1.2

Non-equivalent views of the same person

All the pictures are useful:
we need different descriptions
for different purposes

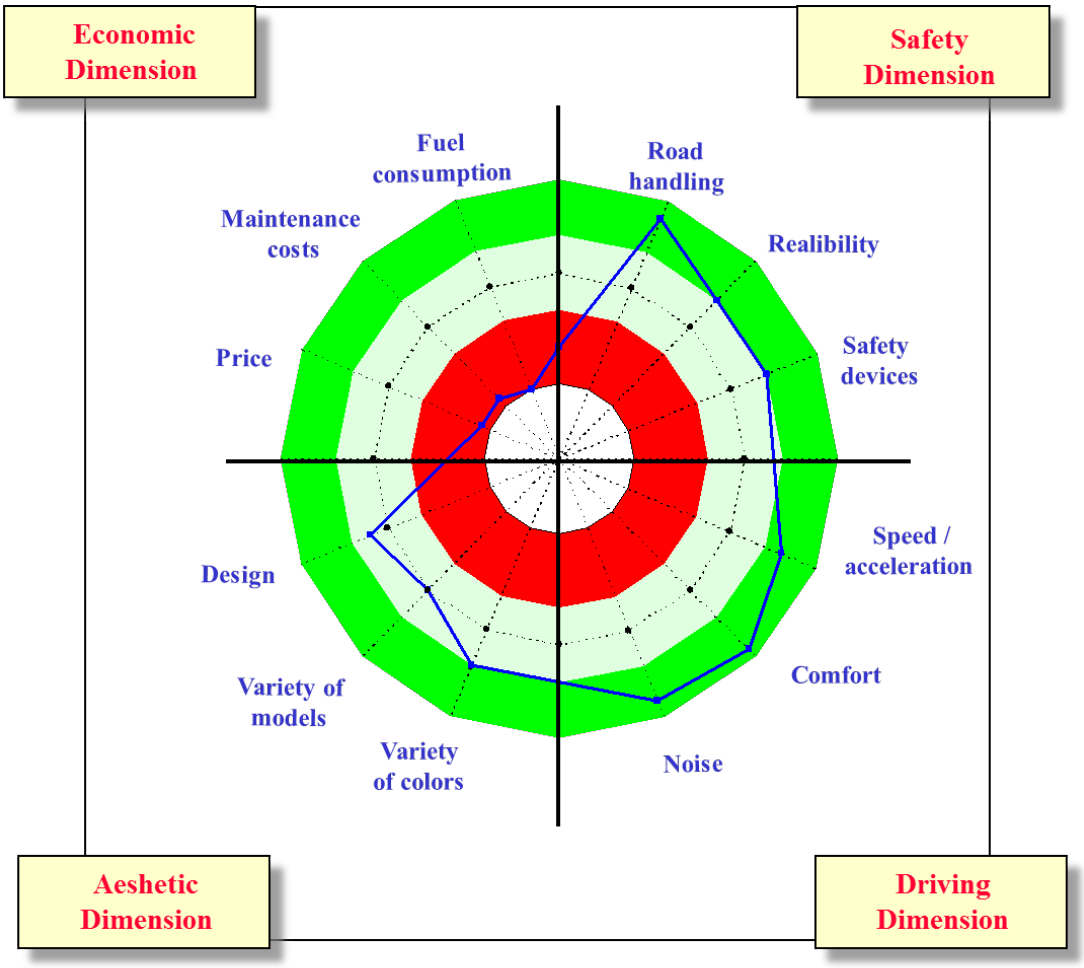
HOWEVER, how can we combine different non-equivalent descriptions to choose …

for instance

- a car?

- A smartphone?

- The partner?



Matrix of the IMPACTs

Criteria	Alternatives a_1	a_2	.	a_n
g_1	$g_1(a_1)$	$g_1(a_2)$	.	$g_1(a_n)$
.	.	.	.	.
g_m	$g_m(a_1)$	$g_m(a_2)$	.	$g_m(a_n)$

Example

	Alternatives→ Criteria ↓	A	B	C
+	g1.1	43	34	2
+	g1.2	Moderate	Very good	Good
+	g1.3	1°	2°	3°
-	g2.1	234	12	100
+	g2.2	≈100	≈135	≈200
-	g3.1	12	34	44
+	g3.2	no	sì	Sì
+	g3.3	12	6	3
+	g3.4	13.2	18	14

The story starts in 1770
when Borda worried whether Academy's decisions reflected who they truly wanted as a president.
His concern was not whether the voters were informed or voted, but rather about how they tallied the ballots.

Through a cleverly constructed example, Borda demonstrated that the Academy's procedure was so bad that they could elect
someone who they actually viewed as the worst!

Clearly, such a misguided procedure should have been tossed into the trash heap of history.
It was not;
instead we still use it
to select members of the Senate, Congress, City Councils, Mayors, Assemblies, and, indirectly, the President of the USA.

This highly flawed approach is
the standard **plurality vote**
where we vote for one candidate
and the winner is the candidate with the most votes.

SAARI: https://zdoc.site/the-symmetry-and-complexity-of.html

From the matrix of the impacts to ranking alternatives

Compensative methods

		A	B	C
+	g1.1	43	34	2
+	g1.2	Mod	Very G	Good
+	g1.3	1°	2°	3°
-	g2.1	234	12	100
+	g2.2	≈100	≈135	≈200
-	g3.1	12	34	44
+	g3.2	no	yes	YES
+	g3.3	12	6	3
+	g3.4	13.2	18	14

BORDA: n-1 score to the first

n-2 to the second

	A	B	C
g1.1	2	1	0
g1.2	0	2	1
g1.3	2	1	0
g2.1	0	2	1
g2.2	0	1	2
g3.1	2	1	0
g3.2	0	1.5	1.5
g3.3	2	1	0
g3.4	0	2	1
BORDA	8	12.5	6.5

		A	B	C
+	g1.1	43	34	2
+	g1.2	Mod	Very G	Good
+	g1.3	1°	2°	3°
-	g2.1	234	12	100
+	g2.2	≈100	≈135	≈200
-	g3.1	12	34	44
+	g3.2	no	yes	YES
+	g3.3	12	6	3
+	g3.4	13.2	18	14

Cost Benefit converts into monetary units

	A	B	C
g1.1	43	34	2
g1.2	5	18	9
g1.3	23	18	12
g2.1	-23	-1	-10
g2.2	10	13.5	20
g3.1	-3	-20	-100
g3.2	0	6	7
g3.3	12	6	3
g3.4	10	15	12
C-B	**77**	**89.5**	**-45**

From the matrix of the impacts to ranking alternatives

NON Compensative methods

	Alt-s→ criteria↓	A	B	C	ranking
+	g1.1	43	34	2	ABC
+	g1.2	Moderate	Very Good	Good	BCA
+	g1.3	1°	2°	3°	ABC
-	g2.1	234	12	100	BCA
+	g2.2	≈100	≈135	≈200	CBA
-	g3.1	12	34	44	ABC
+	g3.2	no	yes	YES	CBA
+	g3.3	12	6	3	ABC
+	g3.4	13.2	18	14	BCA

Rankings	criteria
ABC	4
BCA	3
CBA	2

Rankings	criteria
ABC	4
BCA	3
CBA	2

Standard plurality election

A=4> B=3 > C=2

BORDA argument:

If B were not there?
C:A = 5:4

If C were not there?
B:A = 5:4

A is the WORST!!!

Borda Count:
1st→2, 2° → 1
A=8
B=6+2+4 = 12
C=3+4 = 7

CONDORCET: pairwise comparisons:

A vs B 4: 5

A vs C 4: 5

B vs C 7: 2

Condorcet winner: B,
B beats every other alt.
Condorcet looser: A,
A loses with every other alt.

! Not always BORDA selects the Condorcet winner!

From the impact matrix to the OUTRANKING matrix *(Condorcet methods)*

		A	B	C
+	g1.1	43	34	2
+	g1.2	Mod	Very G	Good
+	g1.3	1°	2°	3°
-	g2.1	234	12	100
+	g2.2	≈100	≈135	≈200
-	g3.1	12	34	44
+	g3.2	no	yes	YES
+	g3.3	12	6	3
+	g3.4	13.2	18	14

'Outranking' matrix

	A	B	C
A	-	4	4
B	5	-	7
C	5	2	-

Number of criteria for which an alternative in the rows is better than the alternative in the columns

	A	B	C
A	-	4/9=44.4%	44.4%
B	55.6%	-	77.7%
C	55.6%	12.3%	

Weight			A	B	C
11	+	g1.1	43	34	2
11	+	g1.2	Mod	Very G	Good
11	+	g1.3	1°	2°	3°
16.5	-	g2.1	234	12	100
16.5	+	g2.2	≈100	≈135	≈200
8.25	-	g3.1	12	34	44
8.25	+	g3.2	no	yes	YES
8.25	+	g3.3	12	6	3
8.25	+	g3.4	13.2	18	14
100					

Equal weight for THEME, area, dimension

Weighted 'Outranking' matrix

	A	B	C
A	-	11+11+8.25 +8.25=39	11+11+8.25+8.25 =39
B	11+16.5+16.5+8. 25+8.25= 60	-	11+11+11+16.5+ 8.25+8.25+8.25= 75.25
C	11+16.5+16.5+8. 25+8.25=60	16.5+8.25= 24.75	-

From the outranking matrix to the ranking: Kemeny & Young-Levenglick method

	A	B	C
A	-	4	4
B	5	-	7
C	5	2	-

	Kemeny score
ABC	4+4+ 7=15
ACB	4+4+2=10
BAC	5+7+4=16
BCA	5+7+5=**17**
CAB	5+2+4=11
CBA	5+2+5=12

An interesting example …

criteri	ordin
24	ABC
2	ACB
16	BAC
15	BCA
27	CAB
16	CBA
100	

Outranking matrix

	A	B	C
A	-	53	42
B	47	-	55
C	58	45	-

A>B, B>C , C>A: cycle!

	I	II	**Borda**	
A	26	43	**95**	**III**
B	31	40	**102**	**II**
C	**43**	17	**103**	**I**

Standard plurality: C

	kemeny score
ABC	150
ACB	140
BAC	144
BCA	**160**
CAB	156
CBA	150

Different example: neither the simple plurality voting neither the two-round voting system elects condorcet Winner

rankings	votes
ABC	7
BCA	3
CBA	5

Borda count
A=14
B=6+7+5 = 18
C=3+10=13

Pairwise comparison:

A vs B 7 : 8

A vs C 7 : 8

B vs C 10 : 5

Condorcet winner: B
Condorcet looser: A

Plurality voting
A=7 > C=5 >B=3

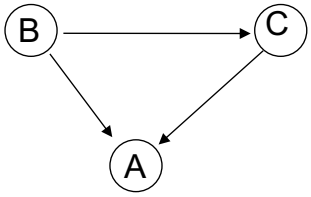
2-rounds: B out, then **C** vs A=8:7

Dalla matrice degli impatti all'ordine delle altern.: metodi *non compensativi* (a la Condorcet) 2° passo con metodi ELECTRE e simili

	A	B	C
A	-	4	4
B	5	-	7.5
C	5	1.5	-

Relazione di preferenza con soglia > 50%

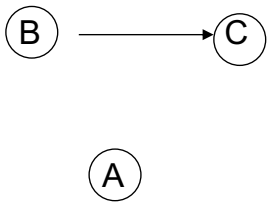
	A	B	C
A		0	0
B	1		1
C	1	0	



Nucleo: {B}

Relazione preferenza con soglia > 60%

	A	B	C
A		0	0
B	0		1
C	0	0	



Nucleo: {A,B}

Nucleo:

a) i nodi appartenenti al nucleo sono fra loro non confrontabili rispetto alla relazione Preferenza;

b) per ogni nodo fuori dal nucleo c'è ne è almeno uno nel nucleo che è ad essi preferito

Is it always a good idea to elect condorcet winner?

Rankings	Votes/criteria
ACBD	52
BCDA	24
DCBA	20
CBDA	4

'Outranking' matrix

	A	B	C	D
A	-	52	52	52
B	48	-	24	80
C	48	76	-	80
D	48	20	20	-

1) Plurality
A=52 > B=24>D=20>C=4

2) Two-steps plurality
A vs B = 52:48

3) Condorcet winner: A

4) Borda Count (3 to the 1st ...)
A=156
B=52+72+20+8= 152
C=104+48+40+12=204
D=24+60+4= 88

In this example most methods elect **A**,
a candidate that is the worse for 48% of the voters.
Borda count elects C, a candidate which ranks
SECOND for 96% of the voters and
FIRST for the 4%.