

*Journée scientifique de la Société Suisse de  
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# De l'innovation en politique : réinventer la représentativité à l'ère des algorithmes

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Problems with  
elections?

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# Elections

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- ❖ Election results are based on :
  - ❖ Electoral system
  - ❖ Institutional criteria
    - ❖ Electoral districts
    - ❖ Count of seats based on population of districts
    - ❖ Council of State vs National Council
  - ❖ Actual votes
    - ❖ « The will of the people »

# Representation

- ❖ Hypothesis: two types of measures to foster adequate representation
  - ❖ Institutional measures (*strong*)
    - ❖ Geography
      - ❖ e.g. US Senate, CH Council of State
  - ❖ *Soft* measures
    - ❖ Party lists representation
    - ❖ Unwritten rules - e.g. magic formula in Swiss Federal Council

[Image: [srf.ch](http://srf.ch)]



# Soft Measures: Gender Gap

- ❖ Worldwide averages
  - ❖ 11.4% of head of state are women (17/149)
  - ❖ 18% of ministers are women
  - ❖ 24% of parliamentarian are women
- ❖ Big differences across countries with some having much less women in politics

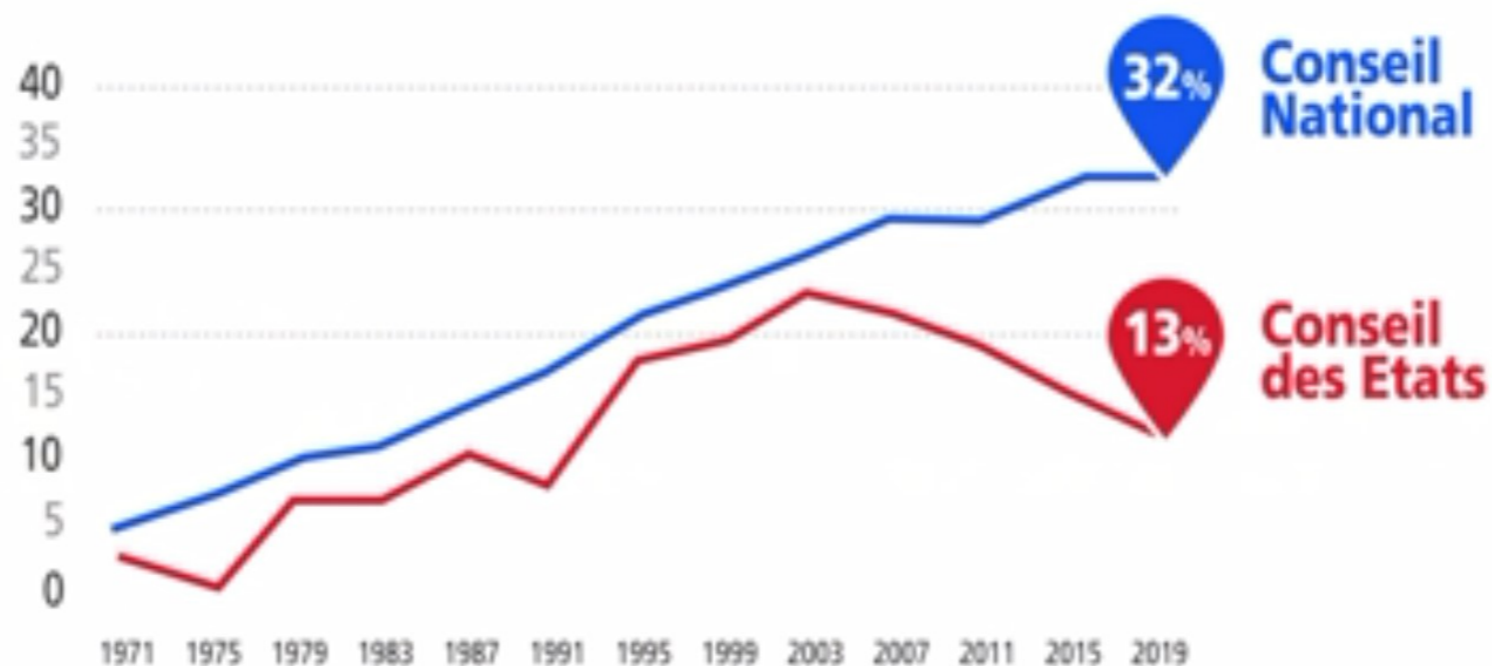
[WEF, Global Gender Gap Index, 2018]

[Image: [politico.eu](http://politico.eu)]



# PROPORTION DE FEMMES ÉLUES

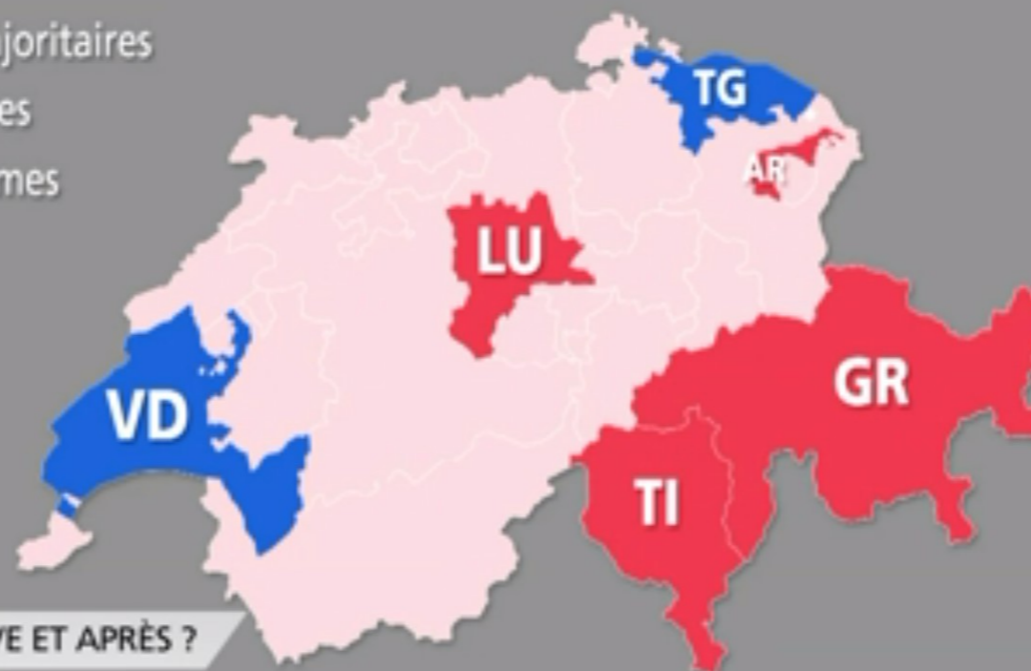
RTS



# FEMMES DANS LES EXÉCUTIFS CANTONAUX

RTS

- femmes majoritaires
- 1 à 3 femmes
- pas de femmes



ÉGALITÉ, UNE GRÈVE ET APRÈS ?

Source : OFS

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# Ensuring Adequate Representation

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Strong measures

Soft measures

Representation guaranteed

No guarantee

Does not depend on parties and voters

Heavily depends on parties and voters

Cannot be changed

Can be changed easily

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# Vote expressing « will of the people »?

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- ❖ When voting, citizen take into account conflicting ideals
  - ❖ Track record
  - ❖ Ideas
  - ❖ Perceived competences
  - ❖ Perceived personality traits
  - ❖ Public image...
  - ❖ Representation (e.g. of women / minorities)
- ❖ The question of representation is never asked directly
- ❖ The « will of the people » cannot be interpreted as a will for a certain representation



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# Challenges

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1. How to get *flexibility* in representation criteria
2. How to ask *representation question* directly to the voters

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# A Third Way

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- ❖ Introducing a «Representation Pact»
  - ❖ Public debate about criteria deemed important for representation of the people
  - ❖ Choice of criteria happens before election itself

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# Representation Pact

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- ❖ Elections where voters can choose representation criteria explicitly
  - ❖ Vote 1 : **Vote for representation criteria**
  - ❖ Vote 2 : **Elect candidates**
  - ❖ Outcome : balanced committee
    - ❖ Committee with the most votes that also respects criteria

 **APPEL**  
**CITOYEN**

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# Representation Criteria

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- ❖ **Gender**

- ❖ exactly 50% men - 50% women

- ❖ **Age**

- ❖ >10% young, >10% senior, >40% active

- ❖ **Region :**

- ❖ min. (not exact) number of seats per municipality, based on population

- ❖ All three criteria accepted

## District de Sion

Sion	10
Savièse, Grimisuat, Arbaz, Veysonnaz	5
Sièges flottants	3
<b>Total des sièges</b>	<b>18</b>

### Nombre de sièges hommes-femmes

Hommes	9
Femmes	9

### Répartition des âges

18 – 30 ans	4
31 – 65 ans	8
+ 65 ans	4
Sièges flottants	2



PHASE I  
16-17 juin 2018

Choix des critères:  
- Parité HF  
- Âges  
- Régions



Critères retenus

PHASE II  
Septembre 2018

Election des  
candidats dans le  
district



Martine	300
Pierre	290
Joseph	280
Charlotte	250
Bernadette	200
Géraldine	190
Alexandre	180
Marie	120

## FONCTIONNEMENT DE LA PRIMAIRE

Algo  
EPFL



Martine	300
Pierre	290
Joseph	280
Charlotte	250
Bernadette	200
<del>Géraldine</del>	<del>190</del>
Paul	180
<del>Marie</del>	<del>120</del>

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# Example

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- ❖ 3 candidates for 2 seats : Marie, Charlotte, Paul
- ❖ Possible election outcomes
  - ❖ Marie & Charlotte
  - ❖ Charlotte & Paul
  - ❖ Marie & Paul



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# How to respect criteria & votes?

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## ❖ Principle

1. Write all possible « lists » of candidates that respect representation criteria
2. Count how many votes each « list » has received
3. The « list » with the most votes wins

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# Example – parity criteria

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- ❖ 3 candidates for 2 seats : Marie, Charlotte, Paul
- ❖ Possible election outcomes
  - ❖ ~~Marie & Charlotte~~
  - ❖ Charlotte & Paul
  - ❖ Marie & Paul

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# Example – parity criteria

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- ❖ Possible election outcomes

- ~~❖ Marie & Charlotte~~

- ❖ Charlotte & Paul

- ❖ Marie & Paul

- ❖ Results

- ❖ Marie            100 votes

- ❖ Charlotte        50 votes

- ❖ Paul              40 votes

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# Example – parity criteria

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- ❖ Possible election outcomes

- ~~❖ Marie & Charlotte = 100 + 50 = 150 votes~~

- ❖ Charlotte & Paul      50 + 40 = 90 votes

- ❖ Marie & Paul          100+40 = 140 votes

- ❖ Results

- ❖ Marie                  100 votes

- ❖ Charlotte            50 votes

- ❖ Paul                    40 votes

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# Computational challenge

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$$\binom{n}{k} = C_n^k = \frac{n!}{k!(n-k)!}$$

- ❖ Combinatorial explosion -> with many candidates, many (many) possible « winning lists »
- ❖ 18 seats – 30 candidates = up to 86 millions possible « winning lists »
- ❖ 18 seats – 41 candidates = up to 200 billions possible « winning lists »

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# Algorithmic solution

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## Multiwinner Voting with Fairness Constraints

L. Elisa Celis, Lingxiao Huang, and Nisheeth K. Vishnoi  
EPFL, Switzerland

June 20, 2018

### Abstract

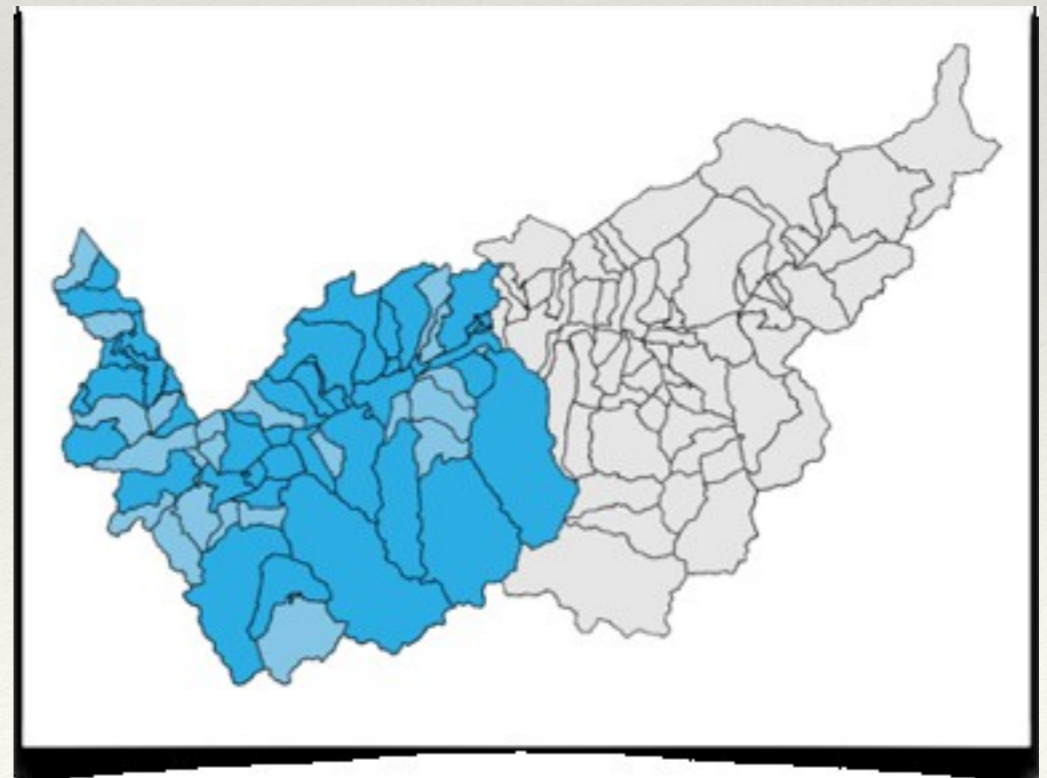
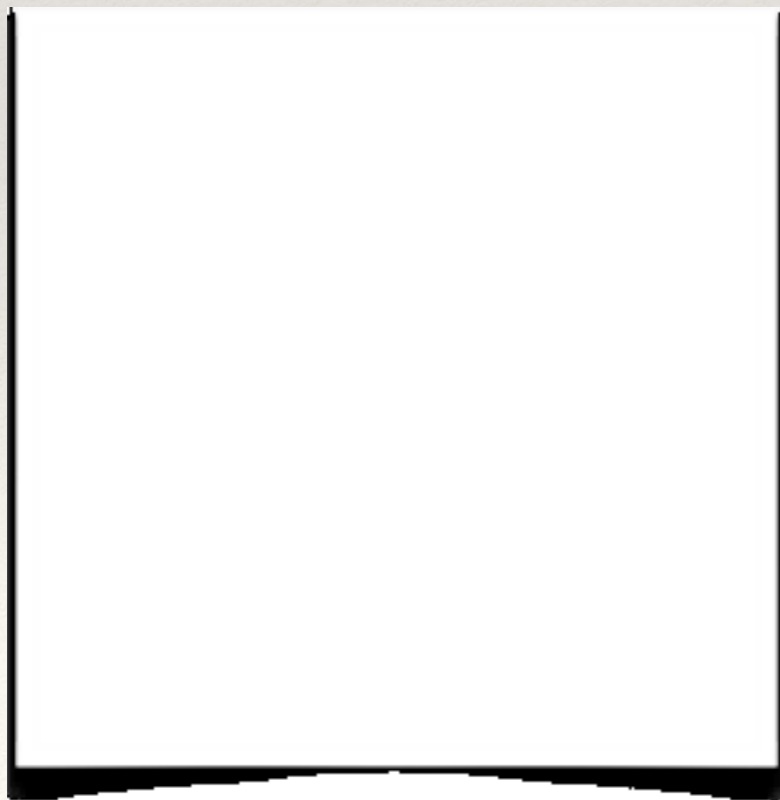
Multiwinner voting rules are used to select a small representative subset of candidates or items from a larger set given the preferences of voters. However, if candidates have sensitive attributes such as gender or ethnicity (when selecting a committee), or specified types such as political leaning (when selecting a subset of news items), an algorithm that chooses a subset by optimizing a multiwinner voting rule may be unbalanced in its selection – it may under or over represent a particular gender or political orientation in the examples above. We introduce an algorithmic framework for multiwinner voting problems when there is an additional requirement that the selected subset should be “fair” with respect to a given set of attributes. Our framework provides the flexibility to (1) specify fairness with respect to *multiple, non-disjoint* attributes (e.g., ethnicity *and* gender) and (2) specify a score function. We study the computational complexity of this constrained multiwinner voting problem for monotone and submodular score functions and present several approximation algorithms and matching hardness of approximation results for various attribute group structure and types of score functions. We also present simulations that suggest that adding fairness constraints may not affect the scores significantly when compared to the unconstrained case.

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# Algorithmic solution

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- ❖ A fast algorithm with **mathematical guarantees** for finding solutions to balanced voting for arbitrary constraints and many natural voting rules. [Celis-Huang-Vishnoi '18]
- ❖ For plurality-at-large voting, they give a solution that is **guaranteed to find the balanced committee with the most votes.**



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# Transparency

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- ❖ Trust in the electoral process requires transparency
  - ❖ List of candidates/criteria published before election
  - ❖ Algorithm open-sourced
  - ❖ Anonymised ballot list published





Votre vote a été reçu. Merci.

QUITTER

← appuyez sur ENTRÉE

### Récépissé de vote

Reçu - [aceccd52-4b28-4ae3-9c15-9ca8822d7eed](#)

Date - June 11, 2018

Heure - 3:07 pm (GMT+2 Europe/Zurich)

Gardez une copie de ce reçu si vous souhaitez contrôler après l'élection que votre vote a bien été dépouillé.

Parité	Âges	Régions	PLUS	MOINS	Récépissé
Oui	Oui	Non	Représentativité des âges	Représentativité des régions	99e9d51e-a824-42af-9f34-08702b0aef64
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	0108a8ca-7957-4543-9b2a-85da0d8a70dd
Oui	Oui	Je m'abstiens	Représentativité des âges	Représentativité des régions	f3559216-76d1-42b1-a0fe-fe632cb57a0d
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	3b0fa3ba-9db6-4c27-80d9-2cafb8a55356
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	2f9f8fa5-b4a4-499b-bac5-44e838e31d13
Oui	Oui	Non	Représentativité des âges	Représentativité des régions	99e9d51e-a824-42af-9f34-08702b0aef64
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	<a href="#">aceccd52-4b28-4ae3-9c15-9ca8822d7eed</a>
Oui	Oui	Je m'abstiens	Représentativité des âges	Représentativité des régions	f3559216-76d1-42b1-a0fe-fe632cb57a0d
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	3b0fa3ba-9db6-4c27-80d9-2cafb8a55356
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	2f9f8fa5-b4a4-499b-bac5-44e838e31d13
Oui	Oui	Non	Représentativité des âges	Représentativité des régions	99e9d51e-a824-42af-9f34-08702b0aef64
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	0108a8ca-7957-4543-9b2a-85da0d8a70dd
Oui	Oui	Je m'abstiens	Représentativité des âges	Représentativité des régions	f3559216-76d1-42b1-a0fe-fe632cb57a0d
Oui	Oui	Oui	Parité femmes-hommes	Représentativité des âges	3b0fa3ba-9db6-4c27-80d9-2cafb8a55356



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The canton of Valais will be revising its Constitution and a Constitutional Assembly has to be elected in November, 2018. The electoral committee thinks that it is important that *\*all\** members of the civil society are represented in the writing of a Constitution -- so they need a way to select a balance committee across important attributes: gen...

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<a href="#">Dist_Herens</a>	Add files via upload 9 months ago
<a href="#">Dist_Martigny</a>	fixed criteria 9 months ago

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# Conclusion

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- ❖ New reflections on election & democracy
- ❖ A practical method to join flexible representation criteria and votes
- ❖ Perspectives :
  - ❖ criteria used also to weight votes at traditional votations ? – today initiatives already require majority of cantons
- ❖ Fundamental question :
  - ❖ What criteria for a « representative democracy » ?

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# Merci !

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