Designing Pareto-optimal Systems for Complex Selection Decisions

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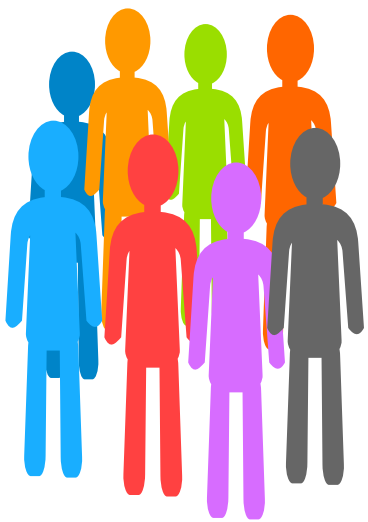
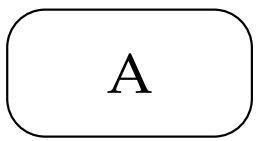
Simple selection decisions

1 Applicant pool → **1 Open position**





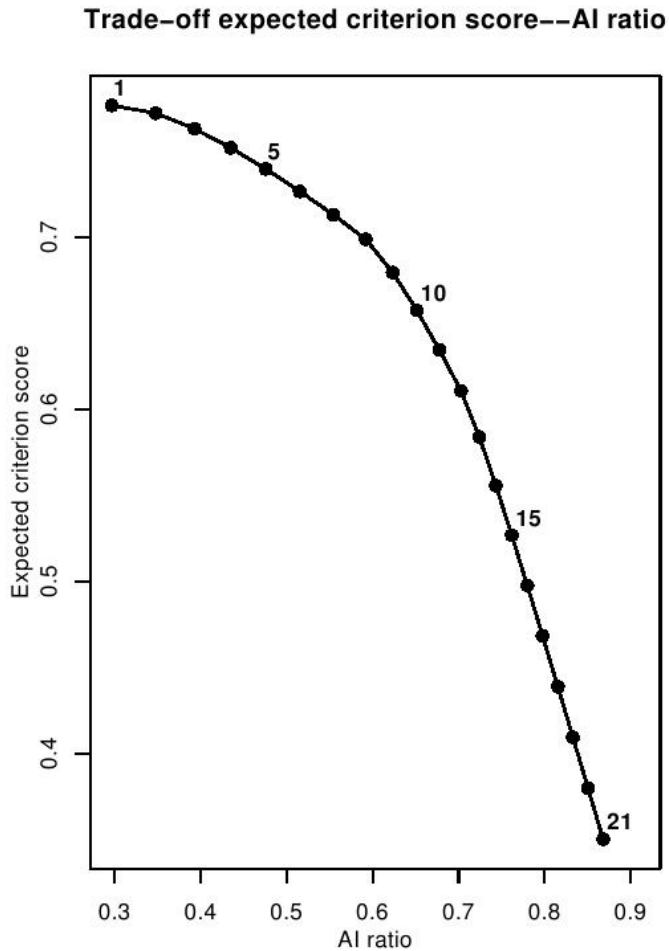
Simple selection decisions cont.

- all applicants apply for one position
- rational selection strategy: based on predictor composite information to maximize expected job performance
- criterion estimate: validity adjusted predictor composite
- select applicants top-down based on single criterion estimate

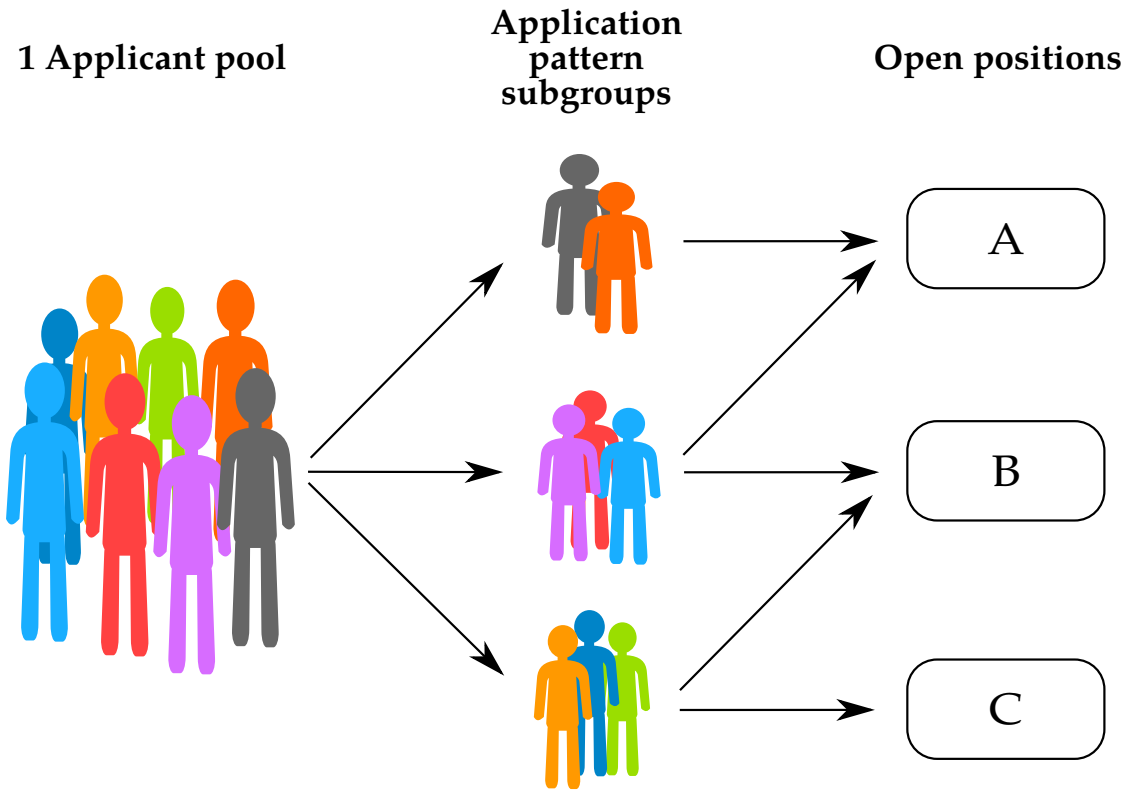
Simple selection outcomes

- second goal of selection, besides selection quality: diversity
- quality-diversity dilemma
- De Corte, Lievens & Sackett, 2007
- data: validities, intercorrelations and effect sizes of predictors
- goal: achieve Pareto-optimal trade-offs between selection quality and adverse impact

Pareto-optimal predictor composites



Complex selection decisions



Complex selection decisions cont.

- Gatewood, Feild & Barrick, 2008 (p.212): "...those [decisions] involving several applicants and several positions."
- a pool of applicants, with some of them interested in several positions simultaneously
- not only accept/ reject, but also assignment decision
- classification decisions (Scholarios, Johnson & Zeidner, 1994): special case of complex selection decisions

Complex selection decisions cont.

- large industrial, governmental organizations
- startup or reorganization of plant/ business unit (Landy & Conte, 2006)
- training/ promotion decisions
- educational settings

Complex selection outcomes

- for each applicant a single criterion estimate is developed
- criterion estimate: the validity adjusted predictor composite
- rational selection: top-down based on criterion estimate
- additional constraint: required quota are met for each job

Complex selection prediction method

Given...

- selection predictors, their effect sizes and validities for several positions
- job application pattern
- subgroups: majority, minority representation
- characteristics of complex selection situation: job quota
- assumption: predictor scores and performance on the job follow a multivariate distribution with same var/ cov but different mean structure in different subgroups

Complex selection prediction method cont.

- estimates outcomes: expected job performance and diversity (AIR)
- for any give choice of predictor weights
- feedback on the implications of specific weighting decisions

Complex selection prediction method cont.

- total applicant pool partitioned in subgroups
- constrained nonlinear program
- objective function: expected job performance of the selected applicants
- nonlinear constraints: quota requirements
- solution values:
  - predictor composite cutoff values in appl. subgroups
  - proportions with which the selected applicants from the subgroups are assigned to the different jobs

Complex Selection Decision Aid

- different weighting of predictor composites → differen trade-off between outcomes
- integration of complex selection prediction method in multi-objective optimization method
- Pareto-optimal trade-offs

Illustration 1

- 3 available jobs
- quota requirements: .25, .10, .15
- 4 available predictors: CA, SI, CO, BI
- majority/ minority: .88/ .12
- 6 different application patterns

Illustration 1 cont.

Data borrowed from Potosky, Bobko & Roth (2005)

Variable	Effect Size	Correlation Matrix			
	d	1	2	3	4
Predictors					
1. Cognitive ability	-0.72				
2. Structured Interview	-0.31	.31			
3. Conscientiousness	-0.06	.03	.26		
4. Biodata	-0.57	.37	.17	.31	
Criteria					
5. Performance Jobs 1-2-3	-0.43	.51	.48	.22	.32

Illustration 1 cont.

Subgroup	Prevalence	Application Pattern
1	.30	Job 1
2	.25	Job 2
3	.20	Job 3
4	.10	Jobs 1 and 2
5	.10	Jobs 1 and 3
6	.05	Jobs 1, 2 and 3

Illustration 1 results

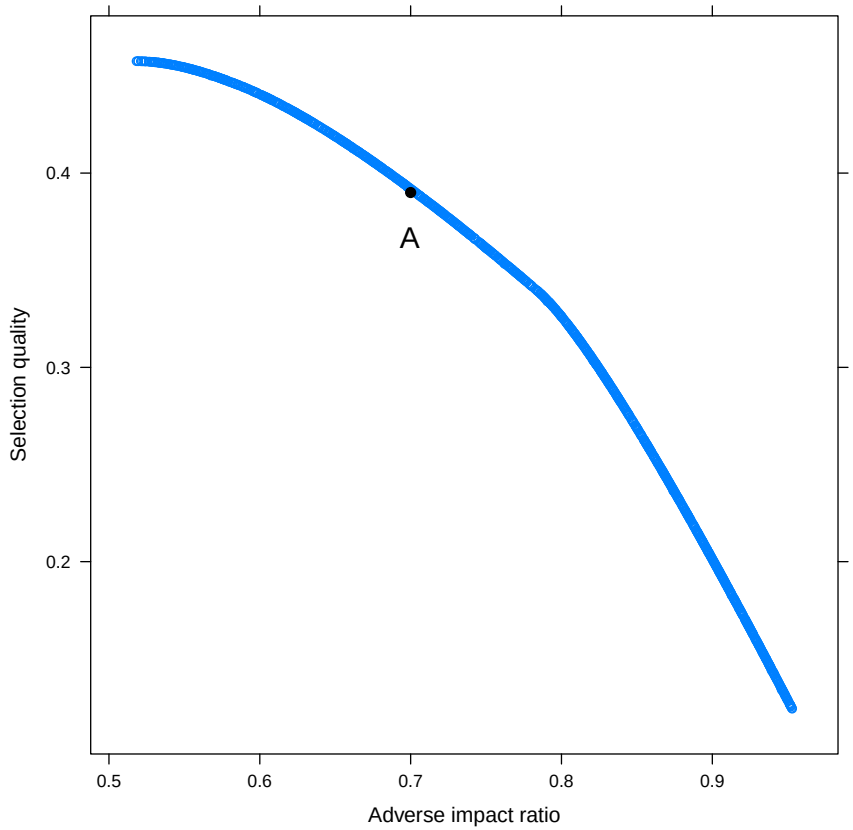
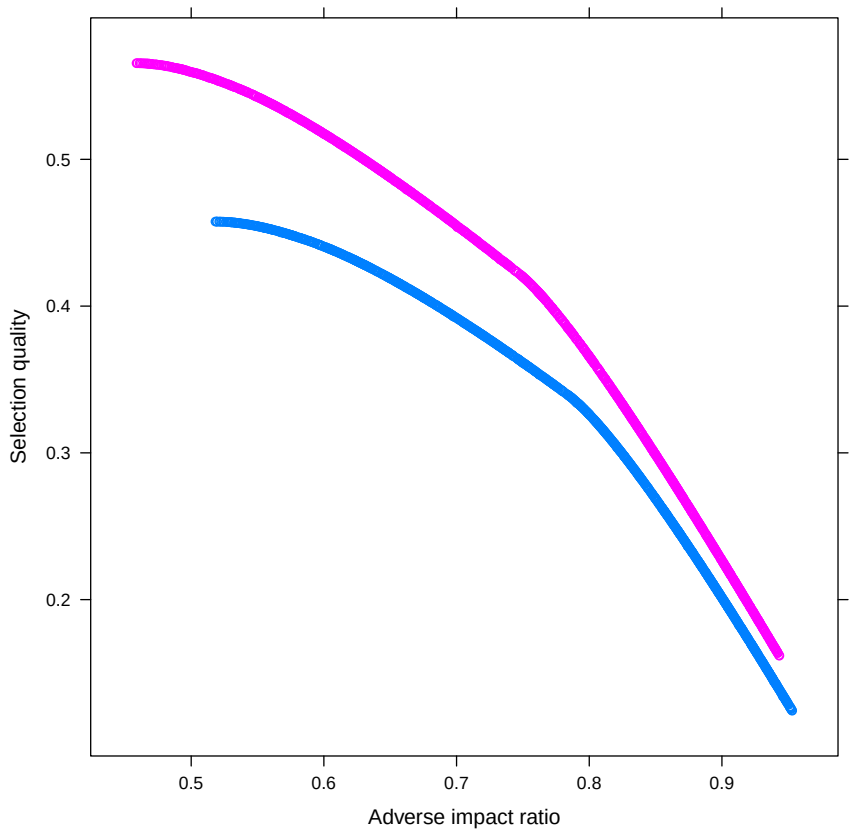


Illustration 2

- same complex selection situation
- treated as 3 different simple selection decisions
- adjusted selection rates:
  1. Job 1: $.25/(.30 + .10 + .10 + .05) = .25/.55$
  2. Job 2: $.10/.40$
  3. Job 3: $.15/.35$
- underestimation of selection ratios

Illustratin 2 results



Conclusion

- method to estimate expected outcomes of complex selection decisions: selection quality and AIR
- based on rational selection and using a single criterion estimate
- integration of prediction method in multi-objective optimization framework
- decision aid: Pareto-optimal predictor composites
- wide range of possible trade-offs
- wrongly applying simple selection format leads to biased estimates

Limitations/ further research

- assumption on distribution of predictor and criterion variables in different subpopulations
- assumption of identical validity in different subgroups
- considering criteria that are evaluated dichotomously
- use of different predictor composites
- different importance for different positions