



UNIVERSITEIT•STELLENBOSCH•UNIVERSITY  
jou kennisvenoot • your knowledge partner

# A PAI SYMPOSIUM AND WORKSHOP ON FAIR ASSESSMENT IN ORGANIZATIONS

## IN SEARCH OF SELECTION FAIRNESS AND MINIMUM ADVERSE IMPACT

**Callie Theron**

**Department of Industrial Psychology  
University of Stellenbosch**

**[ccth@sun.ac.za](mailto:ccth@sun.ac.za)**

**19 October 2007**



---

Department of Industrial Psychology

•  
Faculty of Economic and Management Sciences



## Presentation overview

---



- What are we trying to achieve when we develop selection procedures and why?
- The popular/conventional view on how we get there
- Essential logic underlying selection
- What is meant by adverse impact and how do we determine whether our selection procedures create adverse impact?
- What produces adverse impact, what should we do about it?
- What is meant by unfair discrimination and how do we determine whether the inferences derived from our selection procedure discriminates unfairly?
- How do we ensure selection fairness?
- What are the implications of this stance?



## Personnel selection objectives

---



- Selection procedure should be valid
- Selection procedure should add value/demonstrate positive Brogden-Cronbach-Gleser utility.
- Selection decision-making should be fair/should not discriminate unfairly.
- Adverse impact should be minimized.
- Development procedure should render credible evidence on the validity, utility and fairness of the selection decision-making.
- Methodology of the development procedure must be in agreement with influential technical guidelines [methodology will affect credibility of evidence].
- Use must conform to ethical best practice/code of conduct.



## Employment Equity Bill preamble

---



- Objective is to achieve the laudable vision formulated by former president Mandela in the preamble to the Employment Equity Bill (Republic of South Africa, 1996, p. 5)

*What we are against is not the upholding of standards as such but the sustaining of barriers to the attainment of standards; the special measures that we envisage to overcome the legacy of past discrimination are not intended to ensure the advancement of unqualified persons, but to see to it that those who have been denied access to qualifications in the past can become qualified now, and that those who have been qualified all along but overlooked because of past discrimination, are at last given their due.*



## How are these ideals to be achieved?

---



- Conventional wisdom would dictate that the key is the assessment tool [and the manner in which we use the measures in decision-making]
- Is this view correct?



## Conventional wisdom unpacked

---



- Adverse impact can be avoided through the correct /judicious choice of assessment/selection instruments.
- Selection instruments can be graded in terms of the degree of the adverse impact they create.
- Adverse impact can be avoided by judiciously interpreting the assessment instrument scores [e.g., sliding bands]
- Selection fairness can be attained through the correct/judicious choice of selection instruments.
- Selection instruments can be graded in terms of the degree to which they discriminate unfairly.
- Selection fairness can be assured through the use of unbiased selection instruments.
- Assessment techniques can be certified as Employment Equity Act compliant.



## Essential logic underlying personnel selection

---



- Objective of personnel selection is to add value to the organization by improving the job performance of employees by regulating the flow of employees in, through and out of the organization,
- Ideal, therefore, would be to base selection decisions on measurements  $Y$  of the multidimensional final criterion  $\eta$
- Direct information on  $\eta$ , however, cannot be obtained at the time of selection decision-making.
- Selection decisions consequently have to be based on estimates of performance [i.e.  $E[Y|X]$ ] derived from [predictor] information available at the time of the selection decision.



## Essential logic underlying personnel selection

---



- An accurate estimate of Y will be possible from the predictor information to the extent to which [a] the predictor correlates with a measure of the criterion and [b] the nature of the relationship is known in the appropriate applicant population.
- The two options that could furnish estimates of performance are:
  - To operationalize the person-centered constructs [ $\xi$ ] required to perform successfully on the job [inferred from the job description]; or
  - To operationalize the behavioural constructs that constitute performance [inferred from the job description] outside the job.
- Construct versus content orientated approaches to selection [sign versus sample].



## Adverse impact?

---



- Adverse impact in personnel selection refers to the situation that a specific selection strategy affords members of a specific group a lower likelihood to be selected than members of another group.
- Adverse impact is indicated when there is a substantial difference in the selection ratios of groups that work to the disadvantage of members belonging to a certain group.
- A selection ratio for any group, which is less than four-fifths ( $4/5$ ) or 80 percent of the ratio of the group with the highest selection ratio would typically be regarded as evidence of adverse impact.
- In the conceptualisation of adverse impact it is, however, critically important to appreciate that the selection ratios for the various groups should ultimately be determined by their expected criterion performance conditional on their test performance (derived fairly, without systematic prediction bias) and not the selection ratios that would have resulted if selection would have occurred top-down on the predictor.



## Adverse impact defined its selection ratio's based on $E[Y|X_i;D]$

---



- The **criteria construct** is the focus of interest in selection decisions. Predictor measures should be interpreted criterion-referenced in personnel selection\*. Since selection decisions are based on rank ordered expected criterion performance, the selection ratios in question should therefore be calculated on the  $E[Y|X_i;D]$  distribution. The question thus is whether the selection ratio's based on  $E[Y|X_i;D]$ , derived fairly from the predictor measures  $X_i$ , differ for protected and non-protected groups.
- That selection decisions should not be based on the predictor but rather on criterion estimates derived from the predictor is clearly signalled by the APA sanctioned interpretation of predictive validity and the interpretation of selection fairness favoured by the Guidelines.

\* This introduces the question whether conventional construct-referenced norms are appropriate for personnel selection?



## Generally accepted definitions of validity and fairness

---



- **Validity:** the degree to which accumulated evidence and theory support specific interpretations of scores from a selection procedure entailed by the proposed uses of that selection procedure.
- **Fairness:** According to Cleary (Cleary, 1968, p. 115):  
*A test is biased for members of a subgroup of the population if, in the prediction of the criterion for which the test was designed, consistent nonzero errors of prediction are made for members of the subgroup. In other words, the test is biased if the criterion score predicted from the common regression line is consistently too high or too low for members of the subgroup. With this definition of bias, there may be a connotation of unfair, particularly if the use of the test produces a prediction that is too low. If the test is used for selection, members of a subgroup may be rejected when they were capable of adequate performance.*



## The key is not the assessment tool



- If selection decisions should not be based on the predictor but rather on criterion estimates derived [fairly] from the predictor it would imply that in the final analysis the cause of adverse impact in personnel selection resides in systematic differences in criterion distributions rather than in predictor differences.
- It can be shown that if  $R^2[Y, E(Y|X;D)] < 1$  then:

$$E[Y | X = \mu_{X_1}; D = 0] = \mu_{Y_1}; \sigma^2_{\hat{Y}_1} < \sigma^2_{Y_1}$$

$$E[Y | X = \mu_{X_2}; D = 1] = \mu_{Y_2}; \sigma^2_{\hat{Y}_2} < \sigma^2_{Y_2}$$

- Therefore if the criterion means differ across groups the predicted criterion score associated with the group predictor means will also differ



## The key is not the assessment tool

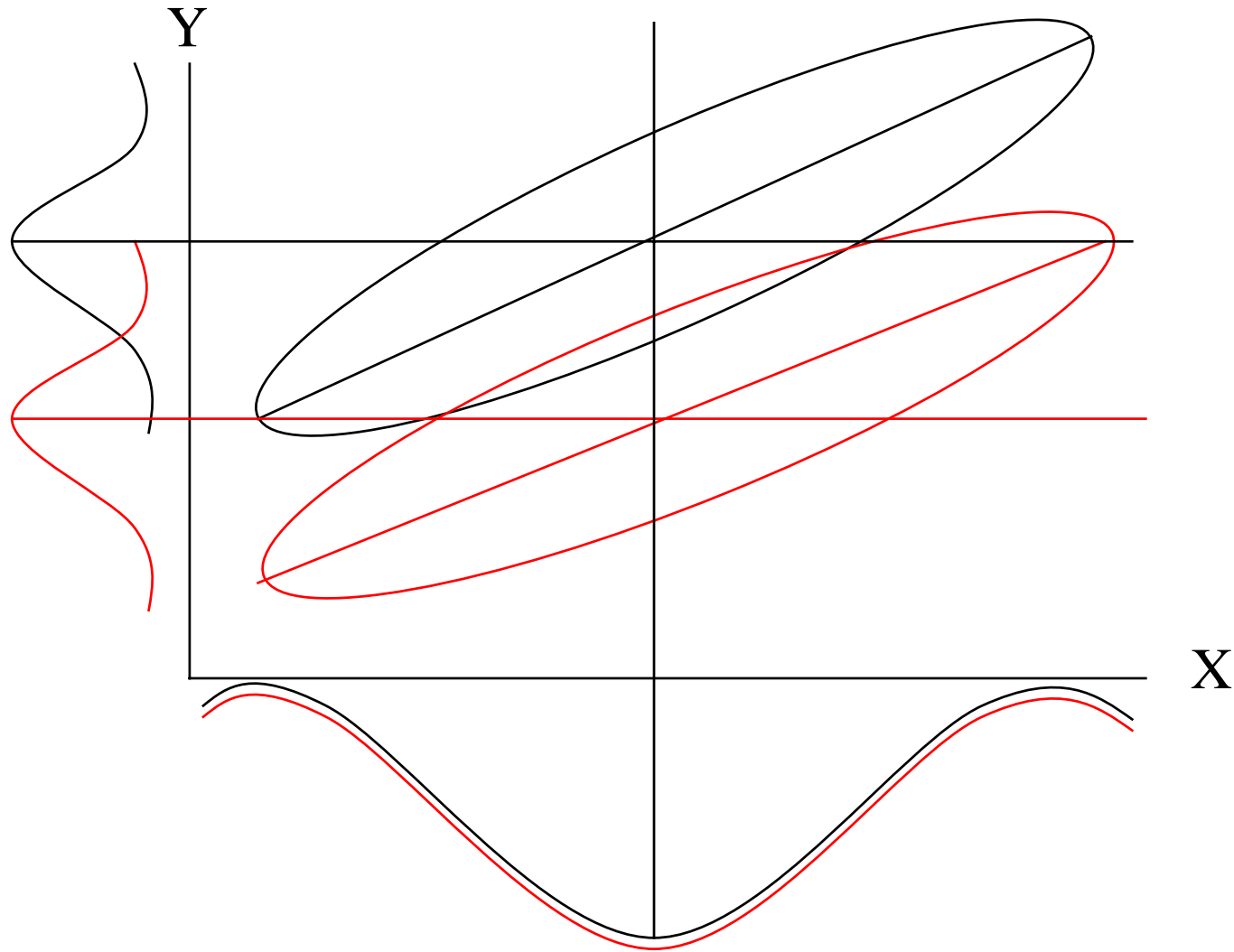
---



- Adverse impact can therefore **not** be avoided through the correct /judicious choice of assessment/selection instruments.
- Selection instruments can **not** be graded in terms of the degree of the adverse impact they create.
- If not even an omniscient selection decision-maker selecting based on merit could avoid adverse impact when the criterion distributions do not coincide, why do we believe this could be achieved by adapting our selection procedures?



# A data simulation to study adverse impact

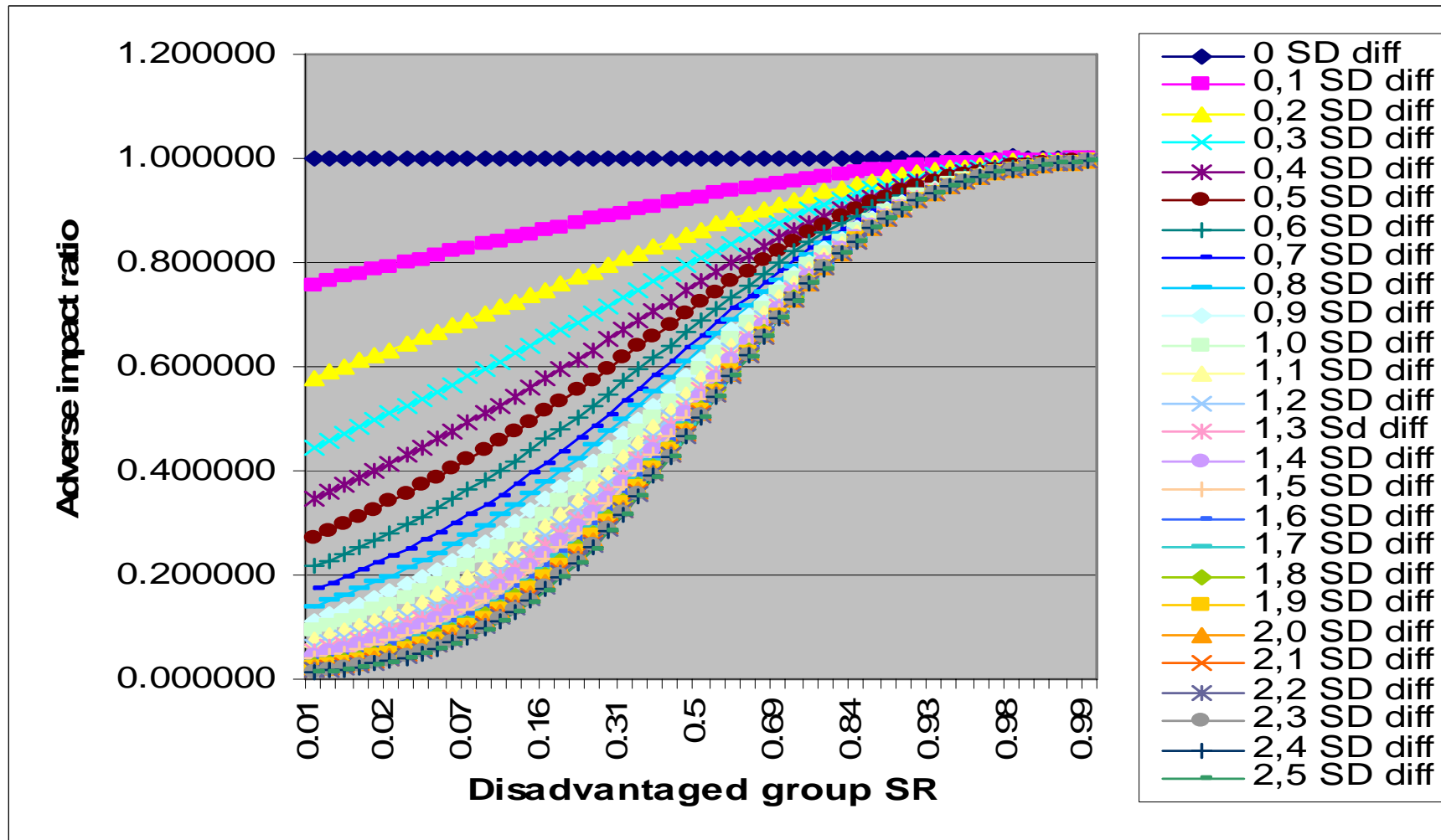




# Adverse impact in fair selection decision-making based on $E[Y|X_1; D]=a + b_1X_1 + b_2D$

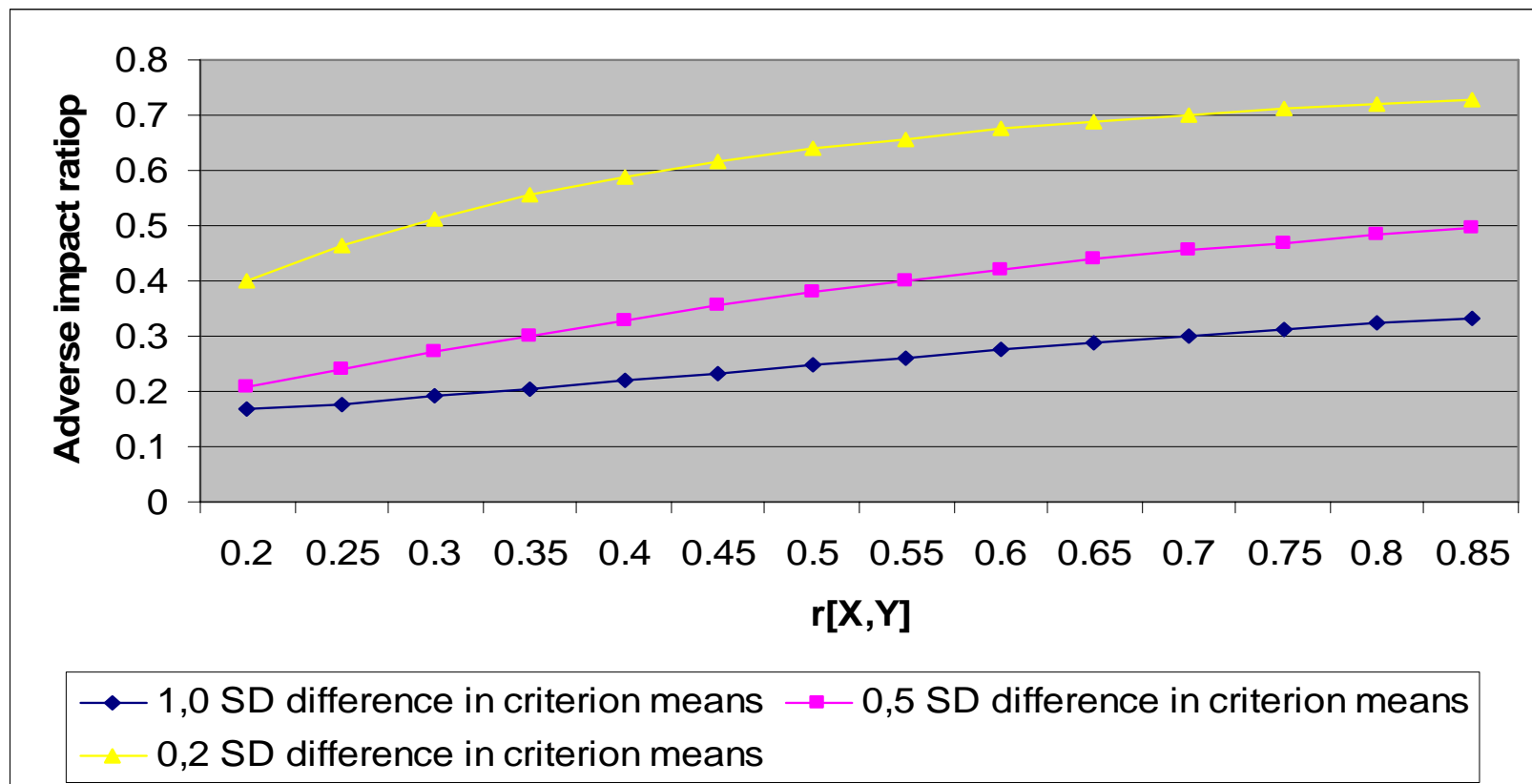


Predictor distributions coincide.  $r[X,Y]=0,30$





# Adverse impact as function of $r$ and criterion difference [fixed $Y_k$ ]





## The key is not the assessment tool

---



- Adverse impact occurs during selection.
- Adverse impact is, however, not caused by the selection procedure.
- The selection procedure should therefore not be expected to solve the problem of adverse impact.
- The solution should be sought in that which produced the differences in the criterion distributions.



## What about the Uniform Guidelines' stance on adverse impact?

---



- The extremely influential and highly respected Uniform Guidelines on Employee Selection Procedures published by the Equal Employment Opportunity Commission (EEOC) requires that:

*Where two or more selection procedures are available which serve the user's legitimate interest in efficient and trustworthy workmanship, and which are substantially equally valid for a given purpose, the user should use the procedure which has been demonstrated to have the lesser adverse impact (Equal Employment Opportunity Commission, 1978, p. 38297).*



## How should we respond to adverse impact?

---



- How the human resource function should respond to the problem of adverse impact in selection would depend on why the systematic differences in criterion distributions exist.
- This is a question that is not raised often enough by human resource management professionals when contemplating the appropriate response to the dilemma outlined above [it is not raised by Uniform Guidelines].
- This question is, however, critically important since remedial actions will only succeed if they deal with the root cause of the problem.
- In the South African context it does not seem unreasonable to attribute at least some part of the systematic group-related differences in criterion distributions to a socio-political system that systematically denied the members of specific groups the opportunity to develop and acquire those crystallised abilities required to succeed on the criterion.



## How should we respond to adverse impact?

---



- To deny the criterion differences and the differences in the underlying competency potential is to deny the history that caused it.
- The solution rather lies in affirmative development interventions aimed at developing those attainments and dispositions needed to succeed on the criterion.
- This puts the assessment of learning potential centre-stage in the search for intellectually honest solutions to the adverse impact problem in South Africa.



## Nothing new

---



- The realization that adverse impact in criterion referenced personnel selection cannot be avoided by the judicious choice of selection instruments is by no means a novel insight. Twenty-three years ago Schmidt and Hunter (1981, pp.1131 & 1134) already declared:

*These findings show that tests do not cause “adverse impact” against minorities. The cumulative research on test fairness shows that the average ability and cognitive skill differences between groups are directly reflected in job performance and thus are real. They are not created by tests. ... But the solution to the problem (of adverse impact) cannot begin until the problem is faced in an intellectually honest way. It is not intellectually honest, in the face of empirical evidence to the contrary, to postulate that the problem is biased and/or invalid employment tests.*



## Preventing a few potential misperceptions

---



- Adverse impact in and by itself does not constitute unfair discrimination.
- Adverse impact **does**, however, constitute discrimination.
- Adverse impact constitutes *prima facie* evidence of unfair discrimination.
- If adverse impact is shown, the burden of proof shifts to the employer to demonstrate the job-relatedness of the selection procedure and that the inferences derived from the predictor scores are fair.



## Adverse impact is only prima facie evidence of unfair discrimination

---



- This interpretation is reflected in Chapter II of the Employment Equity Act (Republic of South Africa, 1998, p. 16), under the heading “Burden of proof”, paragraph 11 :

*Whenever unfair discrimination is alleged in terms of this Act, the employer against whom the allegation is made must establish that it [i.e. the discrimination] is fair.*

- In a similar vein the Constitution states:

*When prima facie evidence of unfair discrimination is shown the defendant must establish that it is fair [i.e. the discrimination]*



## A definition of discrimination

---



- The Promotion of Equality and Prevention of Unfair Discrimination Act (Republic of South Africa, 2000) provides a definition of discrimination:

*(viii) “discrimination” means any act or omission, including a policy, law, rule, practice, condition or situation which directly or indirectly-imposes burdens, obligations or disadvantage on; or withholds any benefits, opportunities or advantages from, any person on one or more of the prohibited grounds*

- Discrimination in terms of this definition, and thereby also adverse impact should thus [psychometrically quite correctly so] not be equated with unfair discrimination.



## Employment Equity Act on unfair discrimination

---



- The Employment Equity Act (Republic of South Africa, 1998, p.14) prohibits **unfair** discrimination by stating that:

*No person may unfairly discriminate, directly or indirectly, against an employee, in any employment policy or practice, on one or more grounds, including gender, sex, pregnancy, marital status, family responsibility, ethnic or social origin, colour, sexual orientation, age, disability, religion, HIV status, conscience, belief, political opinion, culture, language and birth.*



## What is meant by fairness?

---



- Selection fairness represents an exceedingly elusive concept to pin down with a definitive constitutive definition.
- The problem is further complicated by the fact that a number of different definitions and models of fairness exist which differ in terms of their implicit ethical positions and which, under certain conditions, are contradictory in terms of their assessment of the fairness of a selection strategy and their recommendations on remedial action (Petersen & Novick, 1976).



## An interpretation of fairness that serves the EEA's intentions best?

---



- Since the Employment Equity Act (Republic of South Africa, 1998) and the Promotion of Equality and Prevention of Unfair Discrimination Act (Republic of South Africa, 2000) both explicitly prohibit unfair discrimination, a definite verdict on the fairness of the criterion inferences made during selection needs to be pronounced.
- The question is, which of the variety of fairness models that have been proposed (Petersen & Novick, 1976) would serve the spirit of the Employment Equity Act (Republic of South Africa, 1998) best.



## An interpretation of fairness that serves the EEA's intentions best?

---



- Influential technical guidelines on personnel selection procedures seem to favour unqualified individualism as the basic ethical point of departure.
- The basic premise is that applicants with an equal probability of succeeding on the job (being applied for and at the time of the selection decision) should have an equal probability of obtaining the job, irrespective of group membership.
- This fundamental premise, moreover, seems to be in agreement with the anti-discrimination objectives of the Employment Equity Act (Republic of South Africa, 1998) as voiced by the quoted preamble to the Employment Equity Bill (Republic of South Africa, 1996).
- More specifically technical guidelines on personnel selection procedures seem to favour the regression-based models of selection fairness (Cleary, 1968; Einhorn & Bass, 1971)



## Cleary interpretation of selection fairness [once more]

---



- The regression or Cleary model of selection fairness defines fairness in terms of the absence of differences in regression slopes and/or intercepts across the subgroups comprising the applicant population (Petersen & Novick, 1976). According to Cleary (Cleary, 1968, p. 115):

*A test is biased for members of a subgroup of the population if, in the prediction of the criterion for which the test was designed, consistent nonzero errors of prediction are made for members of the subgroup. In other words, the test is biased if the criterion score predicted from the common regression line is consistently too high or too low for members of the subgroup. With this definition of bias, there may be a connotation of unfair, particularly if the use of the test produces a prediction that is too low. If the test is used for selection, members of a subgroup may be rejected when they were capable of adequate performance.*



## Cleary interpretation of selection fairness

---



- The Cleary model thus argues that selection decision-making, **based on expected criterion performance**, can be considered unfair or discriminatory if the position members of specific groups receive in the rank-order resulting from the decision strategy is either systematically too low or systematically too high for members of a particular group.
- This would happen if group membership explains variance in the (unbiased) criterion, either as a main effect or in interaction with the predictors, which is not explained by the predictors, but the **manner in which criterion inferences are derived from predictor information fails to take group membership into account**.
- Under these conditions the criterion inferences derived from selection instrument scores, could be said to exhibit predictive bias.



## Cleary interpretation of selection fairness

---



- The Cleary model examines the fairness of a selection strategy by fitting a saturated regression equation, shown below, and testing the hypothesis  $H_{01}: \beta_2 = \beta_3 = 0$  against the alternative hypothesis  $H_a$ : at least one of the two parameters is not zero:

$$E(Y|X; D) = \alpha + \beta_1 X + \beta_2 D + \beta_3 XD$$

- $X$  is a single predictor or a (clinically or actuarially) weighted combination of predictors, and  $D$  is a dummy variable representing group membership such that  $D=0$  would indicate membership of a protected group and  $D=1$  membership of a non-protected group (or vice versa).



## Clear interpretation of selection fairness

---



- Should  $H_{01}$  not be rejected it would imply that selection decisions based on expected criterion performance **derived from the combined regression equation** is fair.
- Should  $H_{01}$ , however, be rejected it would imply that selection decision-making **based on expected criterion performance derived from the combined regression equation** is unfair because the rank-order resulting from the decision strategy is either systematically too low or systematically too high.
- The inappropriate placement in the selection rank order will result from the use of the combined **regression equation** because the rejection of the null hypothesis would imply that the separate regression equations differ in terms of slope and/or intercept but the prediction rule ignores this fact.



## Cleary implications: 1

---



- $H_{01}$  can be rejected even though the regression of the criterion on the predictor is significant (i.e., the selection instrument demonstrates predictive validity).
- The Employment Equity Act is correct in describing the use of invalid predictors as an unacceptable practice since it violates the fundamental principle of the unqualified individualism position that applicants with an equal probability of succeeding on the job should have an equal probability of obtaining the job, irrespective of group membership.
- The use of a predictor that demonstrates predictive validity, however, is not a sufficient condition to ensure that the fundamental principle comprising unqualified individualism is complied with.



## Cleary implications: 1

---



- Even when a predictor demonstrates predictive validity, (indirect) discrimination can still unfairly disadvantage members of specific subgroups if group membership significantly explains variance in the criterion, which is not explained by the predictor, and the selection strategy fails to take this fact into account.
- The [unqualified] position of the Employment Equity Act (Republic of South Africa, 1998, p. 14) that:  
*it is not unfair discrimination to .... distinguish, exclude, or prefer any person on the basis of an inherent requirement of a job,*  
therefore seems psychometrically questionable.



## Cleary implications: 2

---



- The appropriate remedy, should  $H_{01}$  be rejected, is contingent on the explanation for the rejection of the null hypothesis.
- The Cleary model's prescription for a diagnosed unfair selection strategy thus depends on whether the regression of  $Y$  on  $X$  differs in terms of intercept and/or slope.
- The Cleary solution to the fairness problem dictates that the criterion inferences should be derived from an appropriately expanded multiple regression equation containing the group variable either as a main effect and/or as an interaction effect.



## Clear implications: 2

---



- **All** valid predictors can in principle be used fairly in the regression-based sense of the term.
- Fair or unfair discrimination, therefore, does not reside in the predictor as such.
- Logically it therefore is not possible to ensure selection fairness solely through the judicious choice of selection instruments.
- Stated more strongly - it is a totally futile exercise to try and identify or develop selection instruments that will immunise the human resource practitioner against discriminatory personnel selection practices,
- Psychometrically it is not possible to endorse specific instruments as Employment Equity Act compliant.



## Cleary implications 2 vs Civil Rights Act

---



- In the United States of America the remedies for unfair selection proposed by Cleary (Cleary, 1968), would not be allowed. The problem is that section 106 (1) of the 1991 Civil Rights Act (in Guion, 1998, p. 468) prohibits the adjustment of test scores on the basis of group membership:

*It shall be an unlawful practice for an employer, in connection with the selection or referral of applicants or candidates for employment or promotion to adjust the scores of, use different cutoffs for, or otherwise alter the results of employment related tests on the basis of race, color, religion, sex or national origin.*



## Cleary implications 2 vs Civil Rights Act

---



- This implies that selection unfairness can be evaluated, but once detected cannot be rectified in terms of the logic of the model that was used to detect it.
- If legislative thinking and psychometric rationality disagrees, the latter should challenge the former.
- In South Africa the full implementation of the Cleary model is still in principle possible.



## Cleary implications: 3

---



- All valid predictors used fairly [in the Cleary sense of the term] will result in differential selection ratio's [referred to as adverse impact when large enough] if the criterion distributions of groups comprising the applicant population differ in terms of mean and variance and if a strict top-down selection decision-rule is applied
- All valid predictors used fairly [in the Cleary sense of the term] will result equal selection ratio's if the criterion distributions of groups comprising the applicant population coincide in terms of mean and variance and if a strict top-down selection decision-rule is applied, even if predictor distributions do not coincide



## Cleary implications: 4

---



- By far the majority of selection decisions in South Africa are probably based on clinically (as opposed to actuarially) derived criterion inferences.
- However, the ability of a clinical selection strategy to adapt itself in a manner that would eliminate systematic prediction errors, should they be identified, seems doubtful.
- Given that selection decisions are based on (clinically or mechanically derived) estimates of criterion performance, a critical requirement for effective selection is that the nature of the predictor-criterion relationship should be accurately understood.
- The literature (Dawes & Corrigan, 1974; Goldberg, 1970; Grove & Meehl, 1996; Kleinmütz, 1990; Meehl, 1954; 1957; 1956; Dawes, 1971; Murphy & Davidshofer, 1988; Wiggins, 1973) rather unequivocally considers the mechanical methods of integrating the information used in forming predictions as superior to clinical methods



## Clear implications: 4

---



- Actuarially derived mechanical decision rules probably derive their superior performance record through their ability to capture the nature of the relationship that exists between the various latent predictor variables and the criterion construct with greater accuracy and the greater consistency with which the rule is applied.
- The likelihood that the clinical mind will be able to accurately understand the manner in which even a small subset of these latent variables combine to determine criterion performance and be able to consistently apply this understanding, therefore seems even smaller in cases where group membership has to be considered to accurately estimate job performance.



## Focus on the real challenge

---



- Undeniably the approach advocated here would pose severe practical, technical and logistical challenges to the human resource management professional.
- However, if there is any psychometric merit in the argument outlined above, the Industrial-Organisational Psychology fraternity should rise to the challenge of finding creative and innovative solutions to the obstacles that currently prevent the widespread implementation of an actuarial approach to personnel selection?



## Way forward?

---



- Problems can normally be successfully treated only if their causes are properly understood.
- The fundamental cause of [a] adverse impact and [b] unfair discrimination in personnel selection is in the final analysis not the selection instrument.
- The factors causing adverse impact are different from those causing unfair discrimination.
- Intellectually honest solution to unacceptable fair adverse impact lies in identifying disadvantaged individuals with development potential and aggressively investing in affirmative development interventions.
- Intellectually honest solutions to unfair discrimination lies in finding creative practical ways of overcoming the small N problem preventing the development of actuarial selection models.



## Way forward? ...

---



- There is still the danger that the problem of adverse impact could be erroneously seen as a narrow selection for affirmative development problem.
- Should rather be recognized as a comprehensive OD challenge and approached as such.
- This would require:
  - Visionary transformational affirmative action leadership
  - Organizational buy-in in the developmental interpretation of affirmative action
  - Diversity appreciation interventions to prepare the organization for change
  - Participative career planning
  - Identification of learning potential and affirmative development
  - Coaching and mentoring programmes
  - Performance management