

## Variable constructions in Longitudinal Research: Introduction, and the example of Occupational Information

Dr Paul Lambert and Dr Vernon Gayle  
University of Stirling

Session 1 of the ESRC Research Methods Programme Seminar  
*Longitudinal Data Analysis in the Social Sciences: Variable Constructions in Longitudinal Research*, 11<sup>th</sup> May 2007  
<http://www.longitudinal.stir.ac.uk/variables/>



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### Variable constructions, 11 May 2007

Variable Constructions in Longitudinal Research	
1015-1100	<b>Paul Lambert: Introduction / Occupational Information</b>
	<i>Coffee/tea</i>
1120-1140	<b>Paul Lambert: Ethnicity</b>
1140-1220	<b>Lucinda Platt: Research paper – Ethnicity</b>
	<i>Lunch</i>
1330-1400	<b>Vernon Gayle: Education</b>
1400-1445	<b>Linda Croxford: Research paper - Education</b>
	<i>Coffee/tea</i>
1515-1600	<b>Yaojun Li: Research paper - Ethnicity, Class &amp; Education</b>
1600-1630	<b>Discussion / close</b>

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### Talk 1

<b>1.1) Variable constructions &amp; longitudinal research</b>
<b>1.2) Challenges and problems</b>
<b>1.3) Some further issues</b>
<b>2) Occupational information in longitudinal survey research</b>

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## (i) Longitudinal Survey Research

‘5 approaches to quantitative longitudinal data’

[Lambert and Gayle 2006 – [www.longitudinal.stir.ac.uk](http://www.longitudinal.stir.ac.uk)]

- 1) Repeated cross-sections
- 2) Panel studies
- 3) Cohort studies
- 4) Event history data
- 5) Time series analyses

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## (ii) Variable constructions

*processes by which survey measures are defined  
and subsequently interpreted by research analysts*

- Meaning?
  - Coding frames; re-coding decisions; metric transformations and functional forms; relative effects in multivariate models
  - **Data collection and data analysis**

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## Variable constructions in survey research

- **Their importance...**
  - Hands-on work of survey analysis
  - Critiques of practical outputs
- **Concepts and measures**
- **Existing studies:**
  - Key variables in social research [e.g. Stacey 1969; Burgess 1986]
  - Validity and reliability
  - Harmonisation and standardisation efforts
    - [esp. <http://www.statistics.gov.uk/about/data/harmonisation/>]
  - Cross-nationally comparative research and ‘equivalence’
- *..but seldom central to methodological reviews.. [cf. Raftery 2001]*

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## Linkage from variable constructions and longitudinal research

- **Longitudinal comparability** of concepts and measures
- *{parallel with cross-national comparability}*

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## {some further linkages}

- *Practical work of longitudinal survey analysis:*

Appropriate software skills	<b>Documenting</b>
Confidence in data management tasks	<b>Recoding; merging</b>
Qualities of longitudinal surveys	<b>Extensive studies / data</b>
Analysis of complex survey data	<b>Complex variables</b>
Longitudinal analytical techniques	<b>Categorical / metric...</b>

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## Approaching variable constructions and longitudinal research

- **Challenges and problems**
  - *Ways to approach longitudinal comparability*
  - *Factors impacting on comparability, for different variables*
  - *Further issues*
- **Empirical examples**

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# Talk 1

## 1.1) Variable constructions & longitudinal research

### 1.2) Challenges and problems

### 1.3) Some further issues

## 2) Occupational information in longitudinal survey research

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## 1.2) Some challenges and problems with longitudinal variable constructions

### Issues concerning...

#### 1) Harmonisation

#### 2) Equivalence

#### 3) Life course context

#### 4) Household / family context

#### 5) History of topic

#### 6) Events

#### 7) Methods and Correlations

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### Themes: 1) Harmonisation

• *“a method for equating conceptually similar but operationally different variables..”* [Harkness et al 2003, p352]

• **Input harmonisation** [esp. Harkness et al 2003]

*‘harmonising measurement instruments’ (H-Z and Wolf 2003, p394)*

- unlikely / impossible in longer-term longitudinal studies
- asserted in most short term lngtl. studies

• **Output harmonisation** (‘ex-post harmonisation’)

*[esp. H-Z & Wolf 2003; Braun & Mohler 2003 ; van Deth 2003]*

*‘harmonising measurement products’ (H-Z and Wolf 2003, p394)*

- is most likely in longer-term longitudinal data

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More on harmonisation [esp. HZ and Wolf 2003, p393ff]

- Numerous practical resources to help with input and output harmonisation
  - [e.g. ONS [www.statistics.gov.uk/about/data/harmonisation](http://www.statistics.gov.uk/about/data/harmonisation) ; UN / EU / NSI's; LIS project [www.lisproject.org](http://www.lisproject.org); IPUMS [www.ipums.org](http://www.ipums.org) ]
  - [Cross-national e.g.: HZ & Wolf 2003; Jowell 2007]
- Room for more work in justifying/ understanding interpretations after harmonisation

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Themes: 2) Equivalence

- “the degree to which survey measures or questions are able to assess identical phenonema across two or more cultures”  
[Harkness et al 2003, p351]

**Measurement equivalence**

*involves same instruments and equality of measures (e.g. income in pounds)*

**Functional equivalence**

*involves different instruments, but addresses same concepts (e.g. inflation adjusted income)*

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“Equivalence is the only meaningful criterion if data is to be compared from one context to another. However, equivalence of measures does not necessarily mean that the measurement instruments used in different countries are all the same. Instead it is essential that they measure the same dimension. Thus, functional equivalence is more precisely what is required” [HZ and Wolf 2003, p389]

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## Harmonisation and equivalence combined

### ➤ 'Universality' or 'specificity' in variable constructions

*Universality: collect harmonised measures, analyse standardised schemes*  
*Specificity: collect localised measures, analyse functionally equivalent schemes*

- ❖ Most prescriptions aim for universality
- ❖ But specificity is theoretically better

*!!Specificity is more easily obtained than is often realised!!*

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## Harmonisation and equivalence in longitudinal research

- Hinges upon the subject matter
- Has mostly been explored within empirical applications

Field	Previous	Needs more?
<b>Occupations</b>	✓✓✓✓	✓
<b>Education</b>	✓✓✓	✓✓
<b>Ethnicity</b>	✓	✓✓✓
<i>Income</i>	✓	✓
<i>Housing</i>	-	✓
<i>Attitudes</i>	✓	✓
<i>Health</i>	✓	✓
<i>Caring</i>	-	✓✓
<i>...etc...</i>		

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<b>Themes:</b>	<b>3) Life course context</b>
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- Age, period and cohort effects  
...and their interaction with variable constructions
- Age / life course stage
  - Income and employment trajectories by age / life course
  - Functional form for age effects
- Period and cohort effects
  - Changes over time in age/life-course related trajectories

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<b>Themes:</b>	<b>4) Household / family context</b>
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- ❖ *Most key variables interact with household context*
- ❖ *Most longitudinal surveys have some household data*

- Significant household contexts
  - can change over time
  - can change across the life-course
  - vary according to the subject of study

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<b>Themes:</b>	<b>5) History of topic</b>
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*'History' – time over which variables are relevant*

- Interests in trended change:
  - The longer the trends, the more problematic is equivalence and harmonisation
- Data resources over time
  - Data covering shorter or longer periods
  - Cover differing levels of details in different periods
  - Documentation / supply protocols change over time

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<b>Themes:</b>	<b>6) Events</b>
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*'Events' – Things which occur within period of interest*

- 'Events, dear boy, events'  
[Harold MacMillan, as cited by Stoop 2007]
- Longitudinal surveys and events
  - *{survey data availability}*
  - Occupational restructuring  
[Abbott 2007 – 'Period demographic occupational structure']
  - Educational reforms
  - Immigration
  - etc etc...

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**Themes: 7) Methods and correlations**

- Analytic relations change over time, e.g.
  - Education and income [cf. Harmon and Walker 2001]
  - Ethnicity and demography
  - Occupation and gender
- Methods of multivariate analysis
  - Available methods can drive the variable constructions
  - The drive to include all relevant correlates...
  - Interaction effects and/or structural breaks...
  - Missing data in longitudinal datasets

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Methods and correlations as influencing concepts and measures – example of Event History models

- Time to labour market transitions
- Time to family formation
- Time to recidivism

*Comment: Data analysis techniques relatively limited, and not suited to complex variates*  
⇒ Many event history applications have used quite simplistic variable constructions ('state spaces')

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Talk 1

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## Further issues (1): Re-inventing the wheel

*Student's Law: ...In survey data analysis, somebody else has already struggled through the variable constructions you are working on right now...*

- How to find out?
  - ESDS support desk / webpages [www.esds.ac.uk](http://www.esds.ac.uk)
  - ..ask an expert...??
- How to disseminate?
  - ? Need for a UKDA style depository of variable constructions
  - ? Cf. GEODE [www.geode.stir.ac.uk](http://www.geode.stir.ac.uk)

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## Further issues (2): Documentation and replicability

- Some obvious but important points:
  - 1) Consistency of access to documentation over time
  - 2) Consistency of sampling measures and their impact on variables
  - 3) Inflexibility of older longitudinal data
  - 4) Communication with measures of previous studies

*Substantial work in applying contemporary standards of documentation and replicability [e.g. Dale 2006] to complex longitudinal data [cf. Lambert et al 2007]*

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## Further issues (3): Levels of measurement and the problems of categories

- Categories are easier to envisage / communicate
  - Much harmonisation work  $\equiv$  locating into categories
  - Appearance of measurement equivalence
  - But functional equivalence is seldom achieved
- Metrics are better for functional equivalence
  - E.g. Standardised income
  - How to deal with categorisations?
    - ??Scaled categories??
    - The qualitative foundation of quantity [Prandy 2002a]

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## Further issues (4): Concepts and measures revisited

Fallacy in sociological theorising of variable constructions:

- Conceptual foundations of variable constructions do not guarantee measurement of those concepts [e.g. Prandy 2002b]
  - Example: occupation-based social class
  - Alternative perspectives – Fuzzy sets [Ragin 2000; Goertz 2005]
- The tricky consequence:
  - Measures can only be understood through their empirical correlates
  - Longitudinal empirical correlates can be messy...

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## Talk 1

**1.1) Variable constructions & longitudinal research**

**1.2) Challenges and problems**

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## Using social survey occupational data

Two stage process:

1. **Collect & preserve 'source occupational data'**
2. **Summary / translation of source data**

- This model is a 'scientific' approach
  - Published documentation (at both stages)
  - Replicable
  - Validation exercises
- Social researchers have been not been good at using it...  
[cf. Bechhofer 1969; Marsh 1986; Rose and Pevalin 2003]

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## How to be good?

- 1) Code to documented schemes
- 2) Translate through explicit programmes
- 3) Consider alternative treatments  
*(e.g. for measurement or functional equivalence)*

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## Stage 1: Data collection

- **Coding to an occupational index scheme or schemes:**
  - Occupational Unit Groups
  - Standardised Industrial Classifications
  - Standardised employment status classifications
  - Not quite and not at all standardised occupational units
- Efforts in **input harmonisation** in data collection  
*[e.g. Hoffman 2000; van Leeuwen et al 2003]*
- Most Ingl. data models are **output harmonisation**  
*[e.g. ONS unit linkages; IPUMS; van Deth 2003]*
- Resources for using data assume coding to index schemes  
*[e.g. GEODE [www.geode.stir.ac.uk](http://www.geode.stir.ac.uk)]*

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## Stage 2: Using occupational index schemes (in a longitudinal context)

- Model of measurement equivalence
  - Same codings from the same index units  
*[esp. Ganzeboom and Treiman 2003]*
  - Same codings for different index units  
*[esp. E-SEC; RGSC; EGP]*
  - Same family context principles over time  
*(e.g. father's occupation when aged 14)*
- Functional equivalence is rarely reviewed
  - cf. CAMSIS, [www.camsis.stir.ac.uk](http://www.camsis.stir.ac.uk)

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## Occupational data in longitudinal studies

### *The relative challenges concerning...*

1) Harmonisation	Low (previous work)
2) Equivalence	High (flawed previous work..!)
3) Life course context	High (life course careers)
4) Family Context	High (changed gender profiles)
5) History of topic	High (long spans of data)
6) Events	High (industrial restructuring)
7) Methods & Correlations	Low (well explored)

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## Example: Impact of events on measurement and functional equivalence

- Longer time periods studied
- Periods of economic change
- 'Absolute' and 'relative' social mobility

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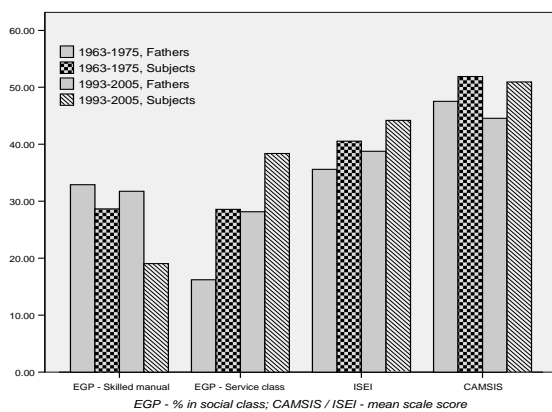
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'By Slow Degrees' social mobility dataset, adult males and their fathers, 1963-2005




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Rant: The importance of specificity in occupation-based social classifications [Lambert et al, forthcoming]

“Occupations are ranked in the same order in most nations and over time. ...Hout referred to the pattern of invariance as the “Treiman constant”. ...the Treiman constant may be the only universal sociologists have discovered.” (Hout and DiPrete, 2006:2-3)

“the idea of indexing a person’s origin and destination by occupation is weakened if the *meaning* of being, say, a manual worker is not the same at origin and destination. Historical comparisons become unreliable” (Payne, 1992: 220, cited in Bottero, 2005:65)

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### How could specificity matter?

- Historical change in occupational circumstances
  - Studying contemporary mobility (e.g. Payne 1992)
  - [Abbott 2006]: Period Demographic Occupational Structure
- Gender differences
  - Male / female occupational structures
  - Substantial differences in class locations
- National differences
  - National labour markets
  - National classification schemes
  - Comparative inequalities
- Level of occupational detail
  - How to incorporate local details in universal schemes?

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### Attainable universality?

- **Setting standards for other researchers and comparable findings** [H&D 2006]
  - of 5 other papers in H&D *RSSM* issue, all discuss occupational classifications, and none exploit Treiman constant
  - in 2005 alone, at least 7 new contemporary occupation based social classifications were proposed within UK sociology...
    - [Chan and Goldthorpe; Oesch; Weeden & Grusky; Rose et al; Lambert et al; Abbott; Glucksman]
  - Periodic updates to government occupational unit group measures
  - Specificity in universal schemes [EGP / E-SEC]

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## Attainable specificity?

*CAMISIS: Measure of occupational stratification reflecting the typical social distances between occupations, arranged in a single hierarchy representing the dominant empirical dimension of social interaction*

### Separate derivations for gender groups, countries, and time periods

- impossibly relativist?
- measurement errors?
- ..only specific if/when scales have been calculated..
- ..and if anyone would ever use them..

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## Empirical assessments

- Are the properties of occupation-based social classifications different for different countries, genders, time periods?
  - Yes!
  - But broad similarity is also a fair model...
- How important / robust are 'specific' differences between the 'same' occupations in different contexts?
  - Mixed evidence...

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## i) The extent of the constant

**CNEF** – Cross-national differences in occupational patterns: Germany / US compared to UK

IS-68 groups	% Fem	%FT	Inc	Educ	Hlth
Architects / Engineers	G, US	G	G, US	G, US	
Educators	G, US	G, US	US	G, US	US
Business leaders	G, US		G, US	US	
Cook / waiter	G, US	US		G	G
Machine fitter	US			G	
Transport operative			US	G	G, US
Labourer / Craftsman	G, US		G	G	G, US

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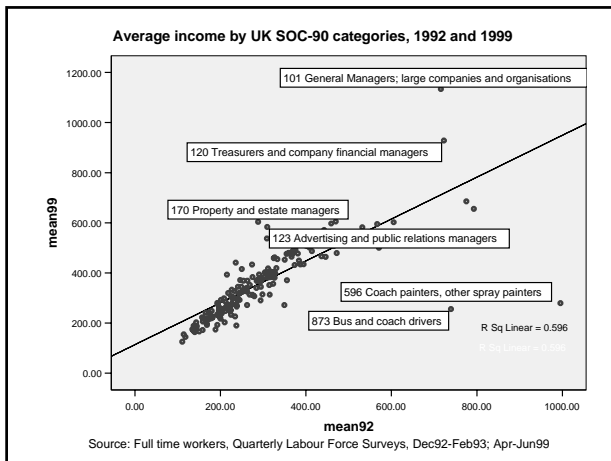
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**HIS-CAM project: HISCO marriage records for inter-generational occupational associations [Lambert et al 2006]**

<b>Netherlands</b>	ZA	1800-1923	348k
	HSN	1812-1938	27k
<b>Germany</b>	Knodel/Imhof	1800-1938*	12k
<b>France</b>	TRA	1803-1938	131k
<b>Sweden</b>	DDB	1803-1889*	19k
<b>Britain</b>	Miles/Vincent	1839-1914	19k
	FHS	1800-1938	42k
<b>Canada</b>	BALSAC	1800-1938	500k*

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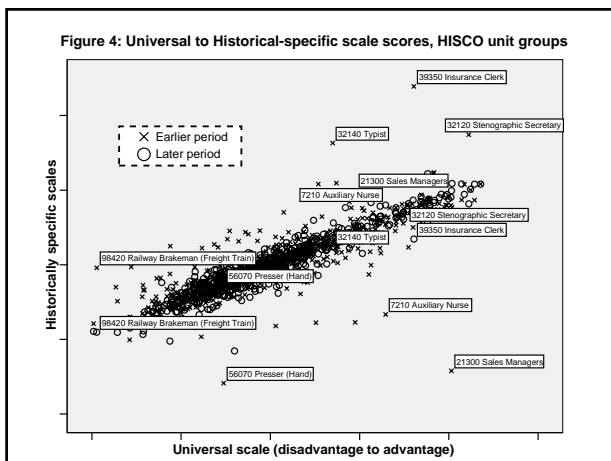
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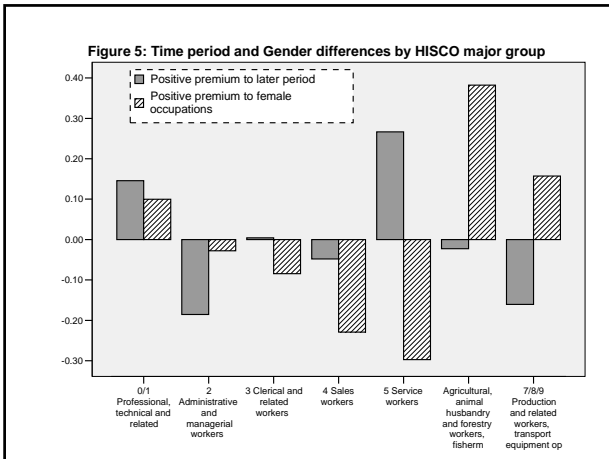
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**The extent of the Treiman constant?**

- There is ample evidence of *some* non-constancy
  - Gender inequalities
  - Sub-populations
  - Particular occupational units
    - Miscellaneous; agriculture; education-related; gender segregated
  - Evolving / Transition economies
  - *All of these are very relevant with longer term longitudinal data*
- Less important when studying national populations / background measures
  - *This is all ok for the Treiman constant, if traded against difficulties of specific schemes*

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**Technologies of occupation-based social classifications: GEODE - Grid Enabled Occupational Data Environment**

*Use of 'Grid' technologies to develop an internet based portal to facilitate data matching between source occupational data and occupational information resources such as social classification categories, stratification scale scores, segregation indexes, etc.*

- ..promises to end scheme operationalisation difficulties...!
- E-Social Science, Stirling University, Oct 05 – May 07
- Contact: [paul.lambert@stirling.ac.uk](mailto:paul.lambert@stirling.ac.uk)

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Some illustrative occupational information resources

	Index units	# distinct files (average size kb)	Updates?
CAMSIS, www.camsis.stir.ac.uk	Local OUG*(e.s.)	200 (100)	y
CAMSIS value labels www.camsis.stir.ac.uk	Local OUG	50 (50)	n
ISEI tools, home.fsw.vu.nl/~ganzeboom	Int. OUG	20 (50)	y
E-Sec matrices www.iser.essex.ac.uk/esecc	Int. OUG*(e.s.)	20 (200)	n
Hakim gender seg codes (Hakim 1998)	Local OUG	2 (paper)	n

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Summary on occupations

- Plenty of guidance on data collection and harmonisation
- Less consistency in processing of harmonised data
- Universality and specificity in understanding contexts
- 3 contexts in occupational research – longitudinal; cross-national; gender

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Summary on variable constructions in longitudinal research

- Measurement or functional equivalence
- Universality and specificity
- Practical issues in data management
- Practical impacts of data analysis

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