HOW TO MEASURE THE FREQUENCY AND THE VARIETY OF A COMPETENCY PORTFOLIO USING BEHAVIOURAL EVENT INTERVIEW

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1. Introduction

In the scientific research a very important step is the data collection. This phase indeed joins the theorical framework of the research with the empirical analysis. Thus the design of a research needs to define in an unambiguous way its different phases: for instance a clear definition of the aims of the research is a premise to identify the variables needed to verify our hypotheses and how we operationalized them.

Sometimes the variable we choose to measure a phenomenon may not be directly observable. This occurs when the phenomenon is complex such as in the study of the personality traits or when we are dealing with individual behavioral competencies (Boyatzis et al, 2015). In all these cases we need to appeal to some methodological tool to collect data referred to the trait or the competency. In literature the problem of measurability of a complex phenomenon goes back to the beginning of the twentieth century. Among the others we mention the Thurstone scale (Thurnstone, 1928), the Guttman scale (Guttman, 1950) and the Likert scale (Likert, 1932).

In these methods the latent variable associated to a trait or a competency is measured by means of several indicators and summarized in different ways. The Likert scale computes the mean of the score recorded in each indicator, while the Guttman scale calculates the score for a subject simply counting the number of the items he/she agree with. With specific regard to the assessment of emotional, social and cognitive competencies, Likert scales continue to be used as the principal response scale in survey research that uses self-reporting or 360-degree competency questionnaire (Batista-Foguet et al., 2009; Boyatzis and Goleman, 2007). The measure of competencies is usually calculated as the average perceived frequency of use of each competency. Another approach adopted in the literature to measure the competency construct is the Behavioural Event Interview (BEI) (Boyatzis, 1998; McClelland, 1998; Spencer and Spencer, 1993). This method is a semi-structured interview in which the respondent is asked to recall recent, specific events in which he or she felt effective (Boyatzis, 2009) in order to determine

specific competencies and how they were deployed as employees faced their most critical situations on the job. The responses are audio taped, transcribed and coded using competency dictionaries with established behavioural indicators (Boyatzis, 1998; Ryan et al., 1999). Therefore, BEI represents an operant, and not a respondent measure, and it contributes to overcome the limits usually ascribed to self and other reporting as well as single-respondent bias (Dunning et al., 2004; Paulhus and Reid, 1999). Indeed, operant measures of competencies have shown a higher predictive validity than self and other report measures (McClelland, 1998). However, as in the case of Likert-scale assessment, the competency is measured only in terms of frequency of manifestation of each single competency (Amdurer et al., 2014; Ryan et al., 1999), namely the number of times a competency is expressed through the activation of the same behavioral indicator. Prior research has neglected another relevant dimension of the competency construct, namely the variety, that can be expressed as the number of different behaviors associated with the same competency adopted by an individual.

This paper aims to contribute to the measurement of the emotional, social and social competencies constructs, introducing a synthetic index that can capture both the frequency and the variety dimensions of the competency construct.

The paper is organized as follow: in section 2 we present the Behavioural Event Interview as a technique useful to collect data to measure a latent variable. Next, in the section 3 we introduce a new index to summarize the data collected by BEI. Afterwards, we present some examples and discuss implications and future research avenues in terms of synthetic index.

2. The Behavioural Event Interview

Behavioural Event Interview (BEI) is a particular semi-structured interview useful to collect data on past behaviour of the interviewee, assuming that the knowledge of his/her past behaviour enable the interviewer to achieve information on the behavioral competencies possessed.

This methodology is a development of the Critical Incident Interview technique (Flanagan, 1954), where the attention of the researcher is focused on gathering information on recent (last 12 months) and specific working life events in which the interviewee felt effective or ineffective. The interviewers detect the intent of the specific behaviors guiding the interviewee with a set of open questions (Boyatzis, 2009)

Since BEI measures how people actually behave in real-life situations, it represents an efficient substitute for direct observation of real behaviors, and in prior studies it has shown a higher predictive validity than respondent measures

(Boyatzis, 2009). Each interview contains the description of several episodes. The episodes are coded using validated codebooks/dictionaries (Boyatzis, 1982) that measure each competency by several independent behavioral indicators, whose number depends on each competency.

At the end of the coding process the set of indicators representing specific competencies are grouped so that each competency is related to a subset of these indicators.

The data are organized in a dataset in which for each episode the behavioural indicators are equal 1 if present and 0 otherwise. In doing so, we are able to measure two dimensions of the competency construct: i) the frequency, namely the number of times a competency is expressed through the activation of the same behavioral indicator across the different episodes, and ii) the variety, that is the number of different behaviors associated with the same competency that has been demonstrated across the different episodes. Since an individual may manifest the possession of a competency through the activation of few or many indicators, and may use them a few times or recurrently, the aim of this paper is to develop a synthetic index that consider the aforementioned dimensions.

3. How to measure a competency using BEI

A dataset constructed by means of BEI contains for each interviewee the information about the competencies manifested. The dataset can be viewed as a set of mutually exclusive sub-matrix each of which consider the *N* episodes narrated by *K* manager and the *M* indicators forming *L* competencies. Therefore we have a sub-matrix for each manager and each competency.

Let n_m be the number of episodes described by the *m-th* interviewee and let i_c be the number of indicators associated to the *c-th* competency. We defined as $I_{c,e,m}$ the number of indicators of the *c-th* competency activated in the *e-th* episode by the *m-th* interviewee. Then we considered the following variable, which gives a measure of the variety of indicators used in the *e-th* episode by the *m-th* interviewee for a *c-th* competency and rewards those who used more than a half of them:

$$v_{c,e,m} = \frac{I_{c,e,m}}{max\left(I_{c,e,m},(i_c - I_{c,e,m})\right)} \tag{1}$$

Similarly, we defined as $E_{c,i,m}$ the number of episodes in which the *i-th* indicator of the *c-th* competency has been activated by the *m-th* interviewee. Then we considered the following variable, which gives a measure of the frequency with which the *i-th* indicator of the *c-th* competency has been used by the *m-th*

interviewee, and rewards those who used that indicator in more than a half of the episodes:

$$f_{c,i,m} = \frac{E_{c,i,m}}{\max(E_{c,i,m},(n_m - E_{c,i,m}))} \quad (2)$$

Finally, we computed the index for the intensity of each single competency included in the model with the following formula:

$$CI_{c,m} = log\left(1 + \frac{F_{c,m}V_{c,m}}{N}100\right) \quad (3)$$

where N = (1+number of episodes without activated indicators for the *m-th* interviewee)*(1+ number of indicators of the *c-th* competency never utilized in the episodes considered). $F_{c,m}$ and $V_{c,m}$ are, respectively, the mean of $f_{c,i,m}$ and $v_{c,e,m}$.

$$F_{c,m} = \frac{1}{n_m}\sum_{i=1}^{n_m} f_{i,c,m} \qquad \text{and} \qquad V_{c,m} = \frac{1}{i_c}\sum_{e=1}^{i_c} v_{c,e,m} \quad (4)$$

The Index *CI* computed for each competency is designed specifically to take into account both the variety of behavioral indicators activated within a given competency, and how frequently they are used (systematically or occasionally) among the episodes told by a manager. The higher the value of the index, the higher the ability of the manager to manifest the competency.

As we highlight previously, the index is computed for each submatrix n_m x i_c.

Both the number of unit elements in the matrix and how they are distributed in the submatrix, affect the value of the index. In other words if we observe a number of unit elements in the submatrix the index assume different values based on how these value are arranged in the submatrix. For instance considering a 5 x 5 submatrix (5 episodes and 5 indicators) with 3 unit elements than there are 4 different patterns that present different values of the index whereas with 4 unit elements the different patters are 9. Figure 1 depicts these features of the index.

Another interesting feature of this index is its behaviour when it grows the number of episodes in which at least one indicator is activated, or similarly when it increases the number of indicators activated at least in one episode. Figures 2 and 3 show the index as a function of the number of unit elements present in a 8x8 submatrix. In particular the figure 2 depicts the tendency of the index considering only one episode out of eight but an increasing number of behavioural indicators activated.

Figura 1 – *Value of index CI for different numbers of activations considering a 5 x 5 submatrix*

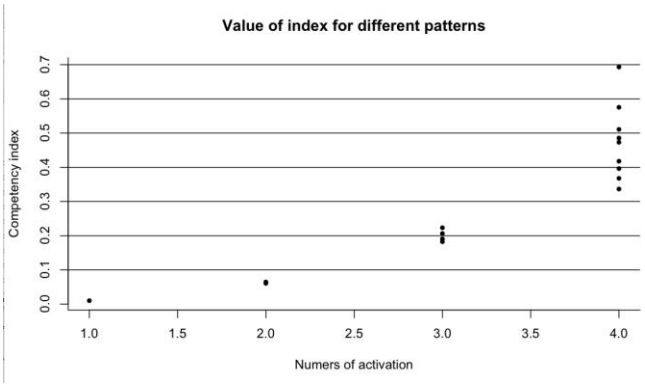
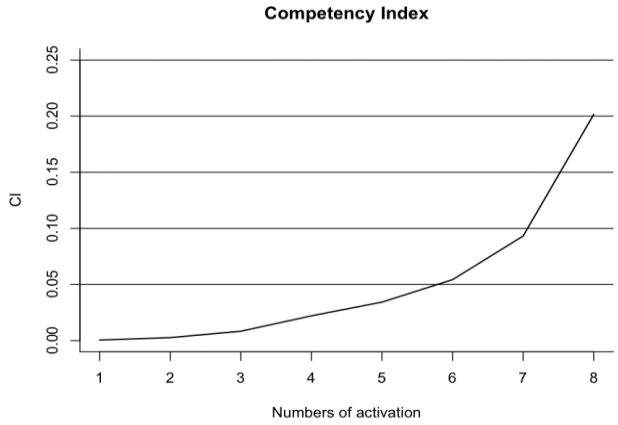


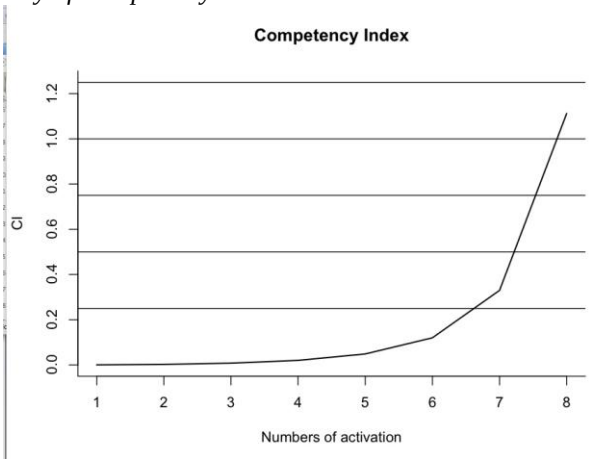
Figura 2 – *Tendency of Competency index based on 8 indicators activated in only one episode*



The curve is convex and this trend may be desirable in the situation considered in this study, namely when we are interested to measure competencies using the technique of BEI. In fact the more a competency is used the less is the likelihood that the subject uses it accidentally.

Figure 3 is similar to the previous one, except as regards to the number of episodes presenting activated indicators, in this case in correspondence of each episode there are an indicator activated. The shape of the curve is similar but the index reaches higher values.

Figura 3 – *Tendency of Competency index based on 8 indicators activate in 8 episodes*



4. Conclusion

In this study we have proposed a new index able to summarize the data collected by the BEI technique. The BEI is a technique very useful when the phenomenon we are interested is observable only by means of a set of behavioural indicators. The drawback of this technique is the complexity of the dataset in terms of its dimension and of the "sparsity" of the data matrix.

The index has some interesting features as it is able to capture both variety and frequency of a competency that a subject is endowed with. Moreover the nonlinear behaviour of the index seems a useful feature to reduce the risk that occasional. We think that the index can be further improved and it needs to be compared to other indices connected to different approaches for instance based on the idea of entropy or spatial proximity.

Appendix

Computation of the index CI.

The appendix provides four examples of the calculation of the index introduced in section 3.3 with the aims on one hand to clarify the construction procedure and on the other hand to point out its capacity to measure consistently different response patterns recorded by BEI. All the examples suppose the measure of a competency by means of five episodes (*E1, E2, E3, E4 and E5)* and four behavioural indicators (*B1, B2, B3* and *B4)*, thus that the data is organized in a matrix 5x4. Starting from this matrix we compute:

- using formula (1), $I_{c,e,m}$ and $v_{c,e,m}$ (reported on the right of the data matrix),
- using formula (2), $E_{c,i,m}$ and $f_{c,i,m}$ (reported below the data matrix),
- using formula (4) $V_{c,m}$ and $F_{c,m}$, (on the bottom of the table);
- using formula (3) the Competency Index $CI_{c,m}$

Table 1 – *Example a: the interviewee activates all the behavioural indicators in only one episode*.

	B1	B2	B3	B4	Total	$I_{c,e,m}$	$v_{c,e,m}$
E1	1	1	1	1	4	4	1.00
E2	0	0	0	0	0	0	0.00
E3	0	0	0	0	0	0	0.00
E4	0	0	0	0	0	0	0.00
E5	0	0	0	0	0	0	0.00
Total	1	1	1	1		# episodes with no indicator	4.00
$E_{c,i,m}$	1	1	1	1			
$f_{c,i,m}$	0.25	0.25	0.25	0.25			
# indicators never activated				0			

$V_{c,m}$ (formula 4 right)	0.200
$F_{c,m}$ (formula 4 left)	0.250
N	5.000
$CI_{c,m}$ (formula [3])	**1.000**

Table 2 – *Example b: the interviewee uses only one behavioural indicator in all episodes*.

	B1	B2	B3	B4	Total		$I_{c,e,m}$	$v_{c,e,m}$
E1	1	0	0	0	1		1	0.33
E2	1	0	0	0	1		1	0.33
E3	1	0	0	0	1		1	0.33
E4	1	0	0	0	1		1	0.33
E5	1	0	0	0	1		1	0.33
Total	5	0	0	0		# episode with no indicator		0.00
$E_{c,i,m}$	5	0	0	0				
$f_{c,i,m}$	1.00	0.00	0.00	0.00				
# indicator never activated				3				

$V_{c,m}$ (formula 4 right)	0.333
$F_{c,m}$ (formula 4 left)	0.250
N	4.000
$CI_{c,m}$ (formula [3])	**2.083**

Table 3 – *Example c: the interviewee activates several (but not all) the indicators in several (but not all) episodes.*

	B1	B2	B3	B4	Total		$I_{c,e,m}$	$v_{c,e,m}$
E1	1	0	0	0	1		1	0.33
E2	1	0	0	0	1		1	0.33
E3	0	1	1	0	2		2	1.00
E4	0	1	0	0	1		1	0.33
E5	0	0	0	0	0		0	0.00
Total	2	2	1	0		# episode with no indicator		1.00
$E_{c,i,m}$	2	2	1	0				
$f_{c,i,m}$	0.67	0.67	0.25	0.00				
# indicator never activated				1				

$V_{c,m}$ (formula 4 right)	0.400
$F_{c,m}$ (formula 4 left)	0.396
N	4.000
$CI_{c,m}$ (formula [3])	**3.958**

Table 4 – *Example d: the interviewee uses all the indicators and he/she uses at least one behavioural indicator in all episodes.*

	B1	B2	B3	B4	Total
E1	1	0	0	0	1
E2	0	0	0	1	1
E3	0	1	0	0	1
E4	0	0	1	0	1
E5	0	0	1	0	1
Total	1	1	2	1	
$E_{c,i,m}$	1	1	2	1	
$f_{c,i,m}$	0.25	0.25	0.67	0.25	
# indicator never activated				0	

	$I_{c,e,m}$	$v_{c,e,m}$
	1	0.33
	1	0.33
	1	0.33
	1	0.33
	1	0.33
# episode with no indicator		0.00

$V_{c,m}$ (formula 4 right)	0.333
$F_{c,m}$ (formula 4 left)	0.354
N	1.000
$CI_{c,m}$ (formula [3])	**11.806**

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SUMMARY

How to measure the frequency and the variety of a competency portfolio using behavioural event interview

In a complex organization such as a firm is increasingly relevant to assess the human capital of the employees with special regard to managerial position. As shown by prior studies, a fine-grained analysis of individual competencies enables firms to better implement human research practices for recruiting, training and managing career of their employees.

In recent organizational literature several studies have underlined the importance to consider the multidimensionality nature of individual competencies.

The cognitive intelligence is only a part of a more complex structure, and the "cognitive framework" has to be extended considering the contributions on emotional and social competencies. Usually these competencies are assessed by self-reporting one-dimensional measure. More recently the Emotional, Social and Cognitive competencies have been considered latent variables and are measured by means of several behavioral indicators.

The aim of our research is to provide a contribution on the competency measurement capturing the complex nature of this construct.

The data for each individual and each competency has been reported in a *n* x *m* matrix of zeros and ones, where *n* is equal to the number of episodes told by the interviewed whereas *m* is equal to the number of indicators used to measure the competency.

Nevertheless this matrix is sparse and as a consequence of this characteristic some summary indices lose importance and sense.

The contribution of this paper is to propose a one-dimensional index useful when we treat with sparse binary matrix. The Index takes into account both the variety of behavioral indicators activated within a given competency, and how frequently they are used among the episodes told by an interviewed. The higher the value of the index, the higher the ability of the interviewed to manifest the competency. In other words, the index is designed to take into account both the depth and breadth of the interviewee's competency portfolio and it allows us to compare different response set with the same sparsity but different pattern. To illutrate the ability to capture the different patterns of response we present some examples in the appendix.

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