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RESEARCH ARTICLE

Cross-Validation of Representational Structures Using the Attribute-Challenge Technique and the Test of Context Independence: The Social Representation of Health

Marie-Anastasie Aim*, Thibaut Decarsin*, Inna Bovina† and Lionel Dany*

In connection with the structural approach of social representations, Lo Monaco, Lheureux, and Halimi-Falkowicz (2008) showed that the Test of Context Independence (TCI) allows to find the same central core components as those retrieved with the Attribute-Challenge Technique (ACT, Moliner, 1989, 2002). As this study was carried out on two 'unavoidable' objects of study of the structural approach (higher education and the ideal group), we aimed to carry out a cross-validation of the representational structure of an object of representation that had never been studied from a structural perspective (i.e., health). An initial study ($N = 223$) was conducted in order to compare structural diagnoses highlighted by the ACT ($N = 105$) and the TCI ($N = 118$). Contrary to Lo Monaco et al. (2008), no element emerged as central using the ACT while the TCI uncovered five central elements (i.e., healthy lifestyle, food, essentiality, prevention, and equilibrium). To ensure that results weren't due to a methodological artefact (misunderstanding of items and phrasing effect), a second study was conducted ($N = 123$). Fifty-two participants completed the ACT and 71 participants to the TCI. In spite of the methodological changes, as in Study 1, no central elements were highlighted by the ACT, whereas three elements (i.e., healthy lifestyle, food, and equilibrium) were found to form the central core by using the TCI. These results were discussed by focusing on the link between the characteristics of the methods used to study the social representations and the characteristics of the objects studied.

Keywords: Social representations; Structural approach; Attribute-Challenge Technique; Test of Context Independence; Health

Introduction

Social representation theory (Moscovici, 1961/1976) is one of the constitutive paradigms of social psychology for the study of social thinking across the world (e.g., Abric, 1994; Jovchelovitch & Priego-Hernández, 2015; Wagner & Hayes, 2005). As a content and process, social representations (SRs) constitute a particular modality of knowledge, generally referred to as common sense knowledge. SRs can be defined as everyday discourse, or even lay thinking/language, in contrast to scientific thinking/language (i.e., hypothetico-deductive reasoning). SRs are:

system(s) of values, ideas and practices with a two-fold function; firstly, to establish an order which will enable individuals to orient themselves in their material and social world and to master it;

secondly to enable communication among the members of a community by providing them with codes for social exchange and a code for naming and classifying unambiguously the various aspects of their world and their individual and group history (Moscovici, 1973, p. xiii).

They have four essential functions, which are understanding and explaining reality (*function of knowledge*), defining and maintaining individual and group identity (*identity function*), guiding behaviours and practices (*guidance function*), and justifying behaviours and standpoints *a posteriori* (*justifying function*) (Abric, 1994).

The structural approach to social representations

There are numerous theoretical and methodological approaches for studying social representations. In the present study, we have adopted the approach proposed by the central core theory (Abric, 1976, 1987, 1994). Nowadays, central core theory plays an important part in research on SRs (e.g., Garnier, 2015; Lo Monaco et al., 2016; Moliner

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& Abric, 2015; Rateau et al., 2011). According to this approach, SR is an organised and structured set of meanings, beliefs, views, and attitudes (Abric, 1994). SRs constitute a particular system composed of two interacting and qualitatively different sub-systems: (a) a *central system* and (b) a *peripheral system*.

(a) The central core theory states that every representation is based on a central core (or central system), which is composed of a limited number of elements. These *central elements* are largely shared, and they are the consensual base of the collective memory and the system of norms in a given social group (Abric, 1993, 2001). The central core performs two essential functions: a *meaning-generating function* (it generates the global meaning of the representation) and a *meaning-organising function* (it determines the nature of the relationships between its constitutive elements). Thus, it gives meaning to the representational object and, as a consequence, to the social practices related to it. The central system is consensual, stable, consistent and rigid, and rather insensitive to immediate context changes (i.e., modification by episodic circumstances) (e.g., Flament, 1995; Lo Monaco, Lheureux & Halimi-Falkowicz, 2008). Furthermore, the central status of a representational element cannot be limited to its quantitative dimension (i.e., the salience of an element). Rather, it has primarily a qualitative dimension (i.e., non-negotiability, which refers to the 'essential' aspect of the element to enable the recognition of the SR).

(b) All the elements that are not central elements are part of the peripheral system (see **Table 1**), which constitute the largest part of the representational content. The *peripheral elements* are more concrete, diverse and flexible than the central core elements. Also, they appear as an interface between the central core and concrete situations (Abric, 1993, 1994, 2001). While allowing the adjustment of the representation to context change due to the flexibility of peripheral elements, one of the peripheral system functions is to defend the central system against contradictions (between cognitions or between cognitions and social experience/behaviours). In other words, peripheral elements play a role in everyday practices and allow the SR to be adapted to the concrete situation without necessarily modifying the structure of the SR (Abric, 1993, 2001; Rateau et al., 2011).

Methodological issues

Various methods have been developed to respond to the theoretical requirement of the central core theory (for an overview and critical approach, see Lo Monaco et al.,

2016): (1) the Ambiguous Scenario Technique (Moliner, 1993); (2) the Basic Cognitive Schemes Model (Guimelli & Rouquette, 1992); (3) the Recognition-of-the-Object Technique (Abric, 2003); and the (4) the Attribute-Challenge Technique (ACT; Moliner, 1989).

The first method developed for providing a systematic diagnosis of the structure of SR, and which is used in many researches, is the Attribute-Challenge Technique (ACT; Moliner, 1989, 2002). This tool is based on an essential property of the central elements: their non-negotiability. In other words, these elements, which assign meaning to the object, are indispensable for defining the object and, without these elements, the object loses its meaning and it cannot be recognized by individuals and groups. The absence of these elements should lead to a shift of representation (Abric, 2003). The ACT is based on a principle of double negation, the consequence of which is that the central elements of an SR are those that, when 'called into question' (first negation) (e.g., 'In your opinion, can we say that the "ideal group" is a group of individuals that *doesn't* get together often?'), lead to a massive refutation (second negation) (e.g., 'Certainly not') of the object of the SR (e.g., Lo Monaco, Lheureux & Halimi-Falkowicz, 2008; Tafani & Bellon, 2003). As Flament (2001) says, the double negation would be 'painful for everyone' (p. 63) and would be psychologically harder than the simple assertion. The double negation discomforts and forces participants to 'weight' their answers, which makes them less personal (Flament, 1995). The effort that participants are required to make is thought to confirm the intelligibility of the relationship between the elements of the SR and the object studied. Despite the validity of results obtained by the ACT, constraints associated with this technique (i.e., use of double negation) have driven researchers to develop new methods to study the SR structure.

A tool was proposed by Lo Monaco, Lheureux, and Halimi-Falkowicz (2008) to overcome this methodological constraint. The Test of Context Independence (TCI) aims to overcome the limits related to the ACT. The TCI is based on the principle that the central core is 'relatively independent of the immediate context' (Abric, 1994, p. 28). Its operationalization takes up the idea of the stability and resistance of central elements to context influences and, *a contrario*, the idea of contingent characteristics of peripheral elements. Peripheral elements can be contradictory (because they are activated, or not, according to the circumstances) and their occasional calling into question has no impact on the general meaning of the representation.

Table 1: Characteristics of the central and peripheral systems of a representation.

	Central system	Peripheral system
Functions	(a) Meaning-generating function (b) Meaning-organising function	(a) Making the central core concrete (b) Regulating the central core (c) Protecting the central core
Properties	(a) Stable (b) Consistent and rigid (c) Rather insensitive to immediate context changes (d) Consensual (defines the homogeneity of the group)	(a) Flexible (b) Bears contradiction (c) Sensitive to the immediate context (d) Supporting the heterogeneity of the group

Lo Monaco, Lheureux and Halimi-Falkowicz (2008) conducted a comparative study of the ACT and the TCI. To do this, they relied on two social objects already studied in the literature of SR: higher education and the ideal group. Their results highlighted an equivalent structural diagnosis for the ACT and the TCI. More concretely, the elements considered as central were the same whatever the tool used. Since the TCI provides the same results as the ACT, this study showed the relevance of using the TCI which is less constraining for participants (i.e., less consequent on cognitive treatment).

Aim of the study

As underlined by Lo Monaco and his collaborators (2016), few studies have provided a critical appraisal of methodologies used in the structural approach. The major issues for the ACT and the TCI methods is their ability to allow a structural diagnosis. To date, only one search has shown that these two methods provide access to the same information (representation structure). The objective of our research was to replicate these results with another social object. Our goal was to compare these two methods (the ACT and the TCI) by studying the representational structure of health, which had only been studied through a socio-genetic/anthropological approach (e.g., Herzlich, 1969). In other words, we wished to explore whether these two tools (based on different properties of the central elements) would highlight a similar structural diagnosis by using a representational object that had never been studied from a structural perspective.

Study 1

Method

Participants. Two hundred and twenty-three participants were involved in this study. Among them, 105 participants (47.1%) completed the ACT and 118 participants (52.9%) replied to the TCI. 82.9% of women completed the ACT and 90.6% completed the TCI ($\chi^2(1, N = 223) = 2.32, ns$) respectively. Concerning the ACT, 37.1% of participants were employed, and 35.9% of participants who completed the TCI were employed ($\chi^2(1, N = 223) = 2.04, ns$). Also, 56.2% of participants who completed the ACT, and 55.6% of those who replied to the TCI ($\chi^2(1, N = 223) = 0.03, ns$) had a qualification higher than the baccalaureate. The average age was 26 ($SD = 10.17$) for the ACT and 27.01 ($SD = 8.17$) for the TCI ($F(1, 221) = 0.67, ns$).

Materials and procedure. In order to compare the ACT and the TCI, the representational content of health was highlighted in a previous study using a verbal association task (Aim et al., 2018). Fifteen items (well-being, absence of illness, hospital, avoiding hospital, doctor, sport, medication, avoiding medication, equilibrium, healthy lifestyle, prevention, food, essentiality, public authorities, and work) were used to conduct and compare the ACT and the TCI. Participants were asked to respond to an item such as 'In your opinion, can we say that a condition is health-related if it does not require you to engage in sporting activity?' for the ACT and 'In your opinion, is health always, in all cases, a condition that requires you to engage in sporting activity?' for the TCI. We used the four

response modalities as in the study of Lo Monaco and his collaborators (2008) (i.e., (1) 'It is most certainly...'; (2) 'It is certainly...'; (4) 'It is certainly not...'; (5) 'It is most certainly not...') to which we added a median response (i.e., (3) 'neither') as recommended in previous work concerning the structural diagnosis of SR (Apostolidis et al., 2011; Dany & Apostolidis, 2007). In addition, we chose the term 'condition' to qualify health as authors have used it when referring to its 'state' or 'status' (Blaxter, 2016).

In both questionnaires, a final item allowed participants to indicate any difficulties in answering the proposed items. In order to reach a diverse public, questionnaires were completed online. A single link was given to participants who were randomly directed to the ACT or the TCI questionnaires. Also, all fifteen items appeared in random order in both questionnaires.

Statistical analyses. Several solutions exist for selecting a decision threshold (Lo Monaco et al., 2016; Moliner, Rateau & Cohen-Scali, 2002). Although the use of the ideal theoretical percentage of 100% is rarely observed, the Kolmogorov-Smirnov test (Abric, 2003; Lo Monaco et al., 2008; Moliner, 2002; Moliner et al., 2002) offers an ideal alternative. Chi-square tests were performed with the aim of comparing centrality rates between the two versions for every item.

From an exploratory point of view, we conducted factorial analyses on the ACT and TCI questionnaires. Responses to each questionnaire were subjected to a Principal Component Analysis (PCA) that is recommended for determining the organising principles that organise a representational field (Doise, Clémence & Lorenzi-Cioldi, 1992). Missing values were excluded.

Results

Structural analyses. With the ACT, no element appeared to be central. In general, refutation percentages of items were low and did not exceed 54.3% (see **Table 2**).

With the TCI, five elements appeared to be central (healthy lifestyle, food, essentiality, prevention, equilibrium). A descriptive analysis shows that the majority of participants chose response 2 (i.e., 'certainly') for three of these central elements (from 50.8% to 52.5%).

Comparisons between centrality rates for each item indicated that 11 items had a different centrality rate obtained by the two methods (the ACT and the TCI). Only two 'peripheral' items (avoiding hospital and doctors) were not significantly different in their centrality rate.

Participants were significantly more likely to report difficulties in understanding some items with the ACT than with the TCI (65.7% vs. 37.3%, $\chi^2(1) = 17.96; p < .001$).

Exploratory factorial analyses. A principal component analysis (PCA) with a Varimax rotation was conducted for each method (the ACT and the TCI) (see **Table 3**). The Kaiser-Meyer-Olkin measure of sampling adequacy indicated the satisfactory factorability of the correlation matrix.

For the ACT questionnaire, $KMO = .80$. Four factors accounting for 60.74% of the total variance emerged from the analysis. Factor 1 (32.63% of the variance explained) appeared to refer to *health as capital* (food, equilibrium,

Table 2: Results obtained by the two techniques for representations of health.

Items	ACT	TCI	Test statistic
Healthy lifestyle	46.7%	97.5% ^a	$\chi^2(1; N = 223) = 73.7, p < .001$, Cramer's $V = .57$
Food	43.8%	94.1% ^a	$\chi^2(1; N = 223) = 67.4, p < .001$, Cramer's $V = .55$
Essentiality	27.6%	92.4% ^a	$\chi^2(1; N = 223) = 98.9, p < .001$, Cramer's $V = .67$
Prevention	50.5%	91.5% ^a	$\chi^2(1; N = 223) = 46.6, p < .001$, Cramer's $V = .46$
Equilibrium	49.5%	88.1% ^a	$\chi^2(1; N = 223) = 39.4, p < .001$, Cramer's $V = .42$
Well-being	43.8%	87.3%	$\chi^2(1; N = 223) = 47.4, p < .001$, Cramer's $V = .46$
Public authorities	32.4%	82.2%	$\chi^2(1; N = 223) = 56.9, p < .001$, Cramer's $V = .50$
Sport	28.6%	78.8%	$\chi^2(1; N = 223) = 56.7, p < .001$, Cramer's $V = .50$
Work	30.5%	78.0%	$\chi^2(1; N = 223) = 50.8, p < .001$, Cramer's $V = .48$
Absence of illness	29.5%	50.8%	$\chi^2(1; N = 223) = 10.5, p < .001$, Cramer's $V = .22$
Avoiding medication	21.0%	38.1%	$\chi^2(1; N = 223) = 7.8, p = .005$, Cramer's $V = .19$
Avoiding hospital	22.9%	33.9%	$\chi^2(1; N = 223) = 3.3, p > .05$, Cramer's $V = .12$
Doctor	23.8%	33.9%	$\chi^2(1; N = 223) = 2.7, p > .05$, Cramer's $V = .11$
Medication	15.2%	6.8%	$\chi^2(1; N = 223) = 4.1, p = .04$, Cramer's $V = .14$
Hospital	13.3%	5.9%	$\chi^2(1; N = 223) = 3.6, p > .05$, Cramer's $V = .13$

Note. The ACT stands for the *attribute-challenge technique*; TCI stands for the *test of context independence*.

^a Elements determined as central on the basis of the Kolmogorov-Smirnov test with a centrality threshold of 87.5% for the TCI ($N = 118$) and of 86.7% for the ACT ($N = 105$).

χ^2 Chi-square test between the rates of replies of each condition.

Table 3: Principal Component Analyses (PCA, Varimax rotation) of the ACT and the TCI questionnaires.

Factors	ACT				TCI					
	1	2	3	4	1	2	3	4	5	6
Eigen value	4.89	1.77	1.37	1.06	3.01	2.06	1.47	1.11	1.08	1.00
% Variance explained	32.63	11.91	9.10	7.09	20.04	13.71	9.81	7.42	7.22	6.67
Food ^a	.79					.78				
Equilibrium ^a	.78						.58			
Healthy lifestyle ^a	.75					.52	.48			
Sport	.56					.75				
Essentiality ^a	.47			.46					.54	
Avoiding hospital		.90						.75		
Work		.60					.70			
Avoiding medication		.58						.79		
Well-being	.52	.55					.67			
Hospital			.87		.79					
Medication			.72		.82					
Absence of illness			.53						.77	
Doctor			.51		.79					
Public authorities				.81						.86
Prevention ^a	.45	.46		.51		.47				.49

Notes. ACT stands for the *attribute-challenge technique*; TCI stands for the *test of context independence*. Only saturations above .30 are presented.

^a Elements determined as central on the basis of the Kolmogorov-Smirnov test with a centrality threshold of 87.5% for the TCI ($N = 118$).

healthy lifestyle, sport, and essentiality). This factor concerned health as something important that must be maintained and developed. Factor 2 (11.91% of the variance explained) referred to *functional health* (i.e., avoiding hospital, work, avoiding medication, and well-being) which implies the capacity to do things by being 'functional'. 'Well-being' also loaded on Factor 1, which makes sense as well-being could be considered as a prerequisite for being able to do things, but also as a goal to be achieved (a capital to maintain/reach). The third factor (9.10% of the variance explained) concerned *medical health* (hospital, medication, absence of illness, and doctor) which refers to healthcare. Factor 4 (7.09% of the variance explained) depicted *public health* (prevention and public authorities). The item 'prevention' loaded on Factors 1 and 2 also. Indeed, preventive behaviours can help to maintain/develop health capital and its functional character. Lastly, 'essentiality' (Factor 1) also saturated on Factor 4, which can be considered as the expression of the necessity of public health in order to maintain the (good) health of the general population.

For the TCI questionnaire, KMO = .65. Six factors accounting for 64.88% of the total variance emerged from the analysis. Factor 1 (20.04% of the variance explained) regarded *medical health* (hospital, medication, doctor) and referred to healthcare. Factor 2 (13.71% of the variance explained) concerned *health as capital* that must be maintained (food, sport, healthy lifestyle). Factor 3 (9.81% of the variance explained) referred to *functional health* (equilibrium, work, well-being). 'Healthy lifestyle' (Factor 2) also loaded on Factor 3. It could be due to the fact that a healthy lifestyle can improve the perception of good health (equilibrium, well-being) and enable people to do things (work). Factor 4 (7.42% of the variance explained), *irrelevance of healthcare* (avoiding hospital and avoiding medication) concerned the needlessness of healthcare when people are in good health. Factor 5 (7.22% of the variance explained), *health as a condition* (essentiality and absence of illness), depicted health as a necessity to stay alive in good shape. Finally, Factor 6 (6.67% of the variance explained) referred to *public health* (prevention and public authorities). 'Prevention' also loaded on Factor 2 given that it can allow people to maintain/develop health capital.

Discussion of Study 1

This study aimed to compare the ACT and the TCI. Unlike the expected results (cf. Lo Monaco et al., 2008), the two methods did not produce the same structural diagnosis. Indeed, the ACT did not uncover central elements. On the contrary, the TCI highlighted five central elements (healthy lifestyle, food, essentiality, prevention, and equilibrium). Although the TCI uncovered central elements, we were not able to highlight the representational structure of health using the ACT. This result can be explained by both methodological and theoretical issues. From a methodological point of view, the ACT can cause difficulties in understanding due to its phrasing as a double negation (Flament, 2001). It would therefore be interesting to replicate this study making sure that results are not

attributable to a misunderstanding of items. Moreover, our choice of phrasing (i.e. health as a 'condition') might have confused participants and it might have encouraged participants to respond to a particular aspect of health. Health is a complex object of study. It can be defined as a state, a condition and a situation (Blaxter, 2016). Thus, it was necessary to verify the results obtained by developing a phrasing that accounts for the broad nature of health.

Furthermore, notwithstanding the larger number of dimensions showed by the PCA based on the TCI data, exploratory PCAs highlighted the existence of four cross-cutting dimensions. Exploratory PCAs conducted for both questionnaires underlined four dimensions (health as capital, functional health, medical health, and public health) of the RS of health using the ACT data, and six dimensions (medical health, health as capital, functional health, irrelevance of healthcare, health as a condition, and public health) of the RS of health using the TCI data. Although dimensions for both questionnaires were not identical, the dimensions 'health as capital', 'functional health', 'medical health' and 'public health' were echoed in both analyses. Moreover, nearly all the central elements underlined by the TCI loaded on health as capital (food, healthy lifestyle, and prevention), functional health (equilibrium and healthy lifestyle), and public health (prevention) dimensions. In other words, the results of the PCAs allow us to show that despite the differences in structural diagnoses for the two tools, individuals do not respond at random (i.e., some dimensions are more significant than others and are found when using both tools).

Before proceeding further with the reflections, we have just discussed, we wish to ensure that these results are not an artefact due to (a) the difficulty of understanding the ACT items, and (b) the naming of the object (i.e., health as a 'condition'), which could be considered too 'limiting' (health being a complex object) and which did not allow us to access abstract elements (i.e., the property of the elements on which the ACT relies to carry out the structural diagnosis). In order to rule out these leads, a second study was conducted.

Study 2

This research aimed to study the effect of methods (ACT vs. TCI) by controlling methodological issues related to the proper understanding of items of the ACT and to the phrasing of items (by avoiding inducing terms such as 'condition').

Method

Participants. One hundred and twenty-three participants participated in this study. Fifty-two participants (42.3%) completed the ACT and 71 participants (57.7%) replied to the TCI. Respectively, 65.4% of women completed the ACT and 71.8% completed the TCI ($\chi^2(1, N = 123) = .58, ns$). Concerning the ACT, 40.4% of participants were employed, and 43.7% of participants who completed the TCI were employed ($\chi^2(1, N = 123) = .13, ns$). Also, 48.1% of participants who completed the ACT, and 62% of those who had replied to the TCI ($\chi^2(1, N = 123) = 2.35, ns$) had a higher qualification than the baccalaureate. The average age was

37.07 ($SD = 15.5$) for the ACT and 38.54 ($SD = 13.8$) for the TCI ($F(1, 121) = 0.63, ns$).

Materials and procedure. As in Study 1, two questionnaires (the ACT and the TCI) to determine the central core of the SR of health were designed. The representational elements were similar to Study 1 (well-being, absence of illness, hospital, avoiding hospital, doctor, sport, medication, avoiding medication, equilibrium, healthy lifestyle, prevention, food, essentiality, public authorities, and work).

The method was relatively similar to the previous study. Only two elements were modified. (a) We added an 'I don't understand' response modality in both questionnaires to ensure that previous results were not due to a lack of understanding of the ACT items. This answer was counted as a missing data for the analyses. (b) Also, we made the choice to no longer refer to health as a 'condition'. In order to account for the complexity of the object, we will refer to it by specifying 'health', and not 'health is a condition' as was the case in the previous study. More specifically, participants were asked to respond to items such as 'In your opinion, can we say that this is health-related if it does not require to you to engage in sporting activity?' for the ACT, and 'In your opinion, does health always require you, in all cases, to engage in sporting activity?'. Once again, questionnaires were completed online in order to reach a diverse public. A single link was proposed to participants who were randomly directed to the ACT or the TCI questionnaires in which all fifteen items appeared in random order.

Statistical analyses. Statistical analyses were the same as in Study 1. In order to determine the central nature of the studied elements we used the Kolmogorov-Smirnov test (Abric, 2003; Lo Monaco et al., 2008; Moliner, 2002; Moliner et al., 2002). Centrality rates between the ACT and the TCI were compared by performing Chi-square tests.

Principal Component Analyses were also performed for the ACT and the TCI. Missing values were excluded.

Results

Structural analyses. With the ACT, no element appeared to be central. In general, refutation percentages of items were low and did not exceed 44.0% (see **Table 4**).

With the TCI, three elements appeared to be central (healthy lifestyle, food, equilibrium). A descriptive analysis showed that the majority of participants chose response 2 (i.e., 'certainly') for all these elements (from 49.3% to 52.1%).

A comparison between centrality rates for each item indicated that 12 items had a different centrality rate obtained by the two methods (the ACT and the TCI). Only three 'peripheral' items (doctor, avoiding medication, and medication) were not significantly different in their centrality rate.

The maximum number of missing responses for an item (i.e., 'I don't understand the response choice') was 4 for the TCI (i.e., essentiality) and 6 for the ATC (i.e., public authorities). Among the items tests ($N = 15$), at least one response was considered missing for 9 TCI items, while this was the case for all ATC items. More specifically for the TCI, 1.4% of data were considered as missing a response for

Table 4: Results obtained by the two techniques for representations of health.

Items	ACT	TCI	Test statistic
Healthy lifestyle	40.4%	97.2% ^a	$\chi^2(1; N = 120) = 49.8, p < .001$, Cramer's $V = .64$
Food	34.6%	91.5% ^a	$\chi^2(1; N = 122) = 43.2, p < .001$, Cramer's $V = .59$
Equilibrium	40.4%	87.3% ^a	$\chi^2(1; N = 117) = 32.2, p < .001$, Cramer's $V = .52$
Prevention	34.6%	81.7%	$\chi^2(1; N = 121) = 26.2, p < .001$, Cramer's $V = .47$
Well-being	46.2%	78.9%	$\chi^2(1; N = 119) = 14.47, p < .001$, Cramer's $V = .35$
Essentiality	36.5%	74.6%	$\chi^2(1; N = 116) = 19.55, p < .001$, Cramer's $V = .41$
Public authorities	21.2%	66.2%	$\chi^2(1; N = 116) = 20.7, p < .001$, Cramer's $V = .42$
Sport	23.1%	59.2%	$\chi^2(1; N = 121) = 14.7, p < .001$, Cramer's $V = .35$
Work	11.5%	53.5%	$\chi^2(1; N = 117) = 21.9, p < .001$, Cramer's $V = .43$
Absence of illness	19.2%	43.7%	$\chi^2(1; N = 117) = 6.5, p = .01$, Cramer's $V = .24$
Avoiding hospital	15.4%	33.8%	$\chi^2(1; N = 117) = 5.7, p = .01$, Cramer's $V = .22$
Doctor	26.9%	26.8%	$\chi^2(1; N = 122) = 0.0, p > .05$, Cramer's $V = .00$
Avoiding medication	15.4%	23.9%	$\chi^2(1; N = 121) = 1.3, p > .05$, Cramer's $V = .10$
Medication	15.4%	5.6%	$\chi^2(1; N = 122) = 3.38, p > .05$, Cramer's $V = .17$
Hospital	13.5%	2.8%	$\chi^2(1; N = 121) = 5.33, p = .02$, Cramer's $V = .21$

Note. ACT stands for the *attribute-challenge technique*; TCI stands for the *test of context independence*.

^a Elements determined as central on the basis of the Kolmogorov-Smirnov test with a centrality threshold of: 83.38% ($N = 67$), 83.50% ($N = 68$), 83.62% ($N = 69$), 83.74% ($N = 70$), and 83.86% ($N = 71$) on the basis of the number of responses retained per items for the TCI, and of 79.95% ($N = 46$), 80.16% ($N = 47$), 80.37% ($N = 48$), 80.57% ($N = 49$), 80.77% ($N = 50$), 80.96% ($N = 51$) on the basis of the number of responses retained per items for the ACT.

χ^2 Chi-square test between the rates of replies of each condition.

'healthy lifestyle' and 'food', and 4.2% for 'equilibrium'. For the elements previously considered as central, 5.6% of responses were considered as missing for 'essentiality', and none for 'prevention'.

Exploratory factorial analyses. A principal component analysis (PCA) with a Varimax rotation was conducted for each questionnaire (see **Table 5**). The Kaiser-Meyer-Olkin measure of sampling adequacy indicated the satisfactory factorability of the correlation matrix.

For the ACT questionnaire, KMO = .71. Four factors accounting for 72.60% of the total variance emerged from the analysis. Factor 1 (41.03% of the variance explained) concerned *health as the absence of disorder* (avoiding hospital, well-being, doctor, absence of illness, and essentiality). This factor concerned the needlessness of medical care when people are feeling well, and when someone (a doctor) certifies this good health status. Factor 2 (13.77% of the variance explained) referred to *health as capital* (food, healthy lifestyle, equilibrium, and sport), which concerns health as something valuable that must be maintained through healthy behaviours. Factor 3 (9.13% of the variance explained) depicted *functional health* (prevention and work) that concerns the ability to do everyday activities thanks to healthy practices. Factor 4 (8.67% of the variance explained) referred to *medical health* (medication, public authorities, hospital, and avoiding medication). The items 'avoiding medication' also loaded on

Factor 1 and also corresponded to the fact that there is no need of medication when people are not ill.

For the TCI questionnaire, KMO = .61. Five factors accounting for 64.31% of the total variance emerged from the analysis. Factor 1 (25.89% of the variance explained) regarded *health as capital* (food, healthy lifestyle, equilibrium, and prevention) in order to maintain/improve health. Factor 2 (12.30% of the variance explained) concerned *medical health* (doctor, hospital, and medication) that may help people to regain health. Factor 3 (10.76% of the variance explained) referred to *health as a condition* (well-being, essentiality, and sport). 'Food' (Factor 1) also loaded on Factor 3. Indeed, healthy food can improve/maintain a good condition. Factor 4 (8.33% of the variance explained), *irrelevance of healthcare*, (avoiding hospital, absence of illness, and avoiding medication) concerned the needlessness of healthcare when people are in good health. Factor 5 (7.02% of the variance explained), *health and social system* (work and public authorities), depicted health as a part of, or related to, social services and practices.¹

Discussion of Study 2 and general discussion

This second study aimed to explore the effect of methods (ACT vs. TCI) by controlling some methodological issues (i.e., good understanding of items, object designation less 'limiting'). Some limitations must be mentioned. Indeed,

Table 5: Principal Component Analyses (PCA, Varimax rotation) of the ACT and TCI questionnaires.

Factors	ACT				TCI				
	1	2	3	4	1	2	3	4	5
Proper value	6.15	2.06	1.37	1.30	3.88	1.85	1.61	1.25	1.05
% Variance explained	41.03	13.77	9.13	8.67	25.89	12.30	10.76	8.33	7.02
Avoiding hospital	.91							.68	
Well-being	.70						.53		
Doctor	.70					.75			
Absence of illness	.69							.42	
Essentiality	.65						.73		
Food ^a	.	.91			.68		.43		
Healthy lifestyle ^a		.90			.74				
Equilibrium ^a		.78			.72				
Sport		.69					.60		
Prevention			.78		.83				
Work			.72				.42		.46
Medication				.84		.79			
Public authorities				.72					.91
Hospital				.56		.68			
Avoiding medication	.45			.55				.85	

Notes. ACT stands for the *attribute-challenge technique*; TCI stands for the *test of context independence*. Only saturations above .30 are presented.

^a Elements determined as central on the basis of the Kolmogorov-Smirnov test with a centrality threshold of: 83.38% ($N = 67$), 83.50% ($N = 68$), 83.62% ($N = 69$), 83.74% ($N = 70$), and 83.86% ($N = 71$) on the basis of the number of responses retained per item for the TCI.

we used five modalities of answer while Lo Monaco and his colleagues (2008) used four modalities of answer when they compared the ACT and the TCI. As we have seen earlier, the number of answer modalities can affect the structural diagnosis. Also, we have modified both the proposed response modalities and the title of the object ('health' instead as 'health is a condition'), which does not allow us to determine the separate impact of these two elements on the results obtained.

Results of structural diagnoses were fairly similar to those of Study 1. No central elements were highlighted with the ACT. As for the TCI, three central elements were underlined (food, healthy lifestyle, and equilibrium). These elements were already highlighted by the TCI in Study 1. Moreover, an exploratory PCA based on the ACT data showed 4 dimensions (health as an absence of disorder, health as capital, functional health, and medical health). Three of these dimensions (health as capital, functional health, and medical health) were similar to those underlined in Study 1. Five dimensions (health as capital, medical health, health as a condition, irrelevance of healthcare, and health and social system) were found using exploratory PCAs based on the TCI data. Four dimensions were quite similar in both studies (health as capital, medical health, health as a condition, and irrelevance of healthcare). Once again, although dimensions highlighted by PCAs for both methods were not identical, 'health as capital' and 'medical health' were echoed in both analyses. Furthermore, all central elements determined by the TCI loaded on the factor 'health as capital'.

Following the first study, two points were modified. (a) an 'I didn't understand' response modality was added (the responses to which were considered missing in the statistical analysis) to ensure that each item was well understood by the participants. (b) We chose to refer to health in its broader sense (i.e., health) rather than the health condition (as was the case in Study 1). We wanted to ensure that the results were not due to a 'limited' vision of health generated by its labelling (i.e., health as a condition). The results showed no change in the structural diagnosis produced by the ACT (i.e., no elements identified as central). However, we observed an impact of these changes on the results of the TCI. As a reminder, five central elements (food, healthy lifestyle, equilibrium, essentiality, and prevention) were highlighted in Study 1. In Study 2, only three of these elements were considered central (food, healthy lifestyle, and equilibrium). We may wonder about the effect of the 'I don't understand' response modality on these results. In view of the number of data considered missing for each item, this response method did not have the same impact on all the elements tested and must be linked to the characteristics of the object studied. Indeed, the representational elements for which the number of non-responses was lowest were also the most 'concrete' and normative (i.e., healthy lifestyle, food, and prevention); contrary to 'equilibrium' and 'essentiality', which refer to more abstract sensations and notions. Note, however, that the 'modification' of the structural diagnosis between Study 1 and Study 2 cannot be explained solely by this modification. No missing data were found

for 'prevention', which was considered central in Study 1 but was no longer central in Study 2. In our opinion, this result mainly indicates an effect of the terminology used to designate the object in the structural diagnosis. In relation to the characteristics of the object, we can assume that the health condition depends on the preventive practices of the individual, whereas health in general does not depend exclusively on these practices.

The results from these two studies (i.e., different structural diagnoses of two elements) can also be considered from a theoretical point of view. This reflection seems all the more relevant if we consider the important distribution of responses for the modality 'certainly' (i.e., instead of the modality 'most certainly'), which reflects the 'relative' adherence to insensitivity to the immediate context. It also seems important to note that the central elements highlighted by the TCI refer to the maintenance of 'health capital'. In this context, the expression of relative independence from context seems to be consistent with the difficulty associated with the constant application (i.e., 'always, in all cases') of these maintenance practices. Otherwise, the participants' responses show that these elements cannot be thought of as totally independent of the context in which they are expressed or implemented: it is desirable to adopt health practice rules, but it is not always possible to achieve them in a 'strict' way. Considering the particularly normative nature of the elements of the SR of health, individuals would be more likely to 'recognize' elements that constitute the contemporary 'imperative of health' (Lupton, 1995), biopower (Foucault, 2004), and its governmentality (Fassin & Memmi, 2004). Although based on the 'relative independence from context' of the central element, the formulation of the TCI (i.e., 'always, in all cases') refers much more to strict context independence. Such a formulation may have contributed to the emergence of prescriptive elements (e.g., in absolute terms, one would have to eat 'correctly' every day), which would rather provide information about the 'normative' character of some of the health-related cognitions. In our opinion, and according to Quenza (2005), the structural approach must exceed a mentalist social cognition paradigm and move towards a social cognition that reflects the sociocultural conditions of creation and transformation of thought. 'Perception and cognition are usually not just operations in the head, but transactions with the world' (Neisser, 1976, p. 11). Conflict and ambivalence emerge not only as motivational forces but also as structural properties (Quenza, 2005, p. 93).

Furthermore, according to Flament (1994), cognition can be descriptive, functional or prescriptive/normative. Owing to the normative nature of health (e.g., Lupton, 1995), it seems interesting to consider that prescriptive/normative cognitions studied in the field of SR are mostly conditional (Flament, 1994). The two objects on which the comparative study by Lo Monaco and his colleagues (2008) focused are of a more descriptive or functional nature (i.e., higher education and the ideal group). It could thus be relevant to replicate this comparative study with other objects, having in particular important normative stakes, in order to study the impact

of the formulation of this method on the established structural diagnoses. Overall, the theoretical-methodological points we have just mentioned question the validity of the structural diagnosis carried out via the TCI. Nevertheless, it seems particularly complex to develop a method making it possible to rule on 'relative independence', as formulated by Abric, because the contingent character of this property makes its assessment difficult or even impossible.

Furthermore, this methodological change did not highlight central elements using the ACT. As outlined above, this method is based on the symbolic property of the central elements and their 'non-negotiable' nature. The functioning of the central core of an SR is governed by the process of activation (Abric, 2001). This essential process accounts for the property of central elements to 'define the meaning of the object' (Abric, 2001, p. 87). In view of the results obtained, we could thus wonder whether the formulation of the ACT items makes it possible to activate the central elements associated with health. In other words, we question the link between the characteristics of the central elements on which both methods are based (i.e., 'non-negotiability' for the ACT and 'insensitivity to immediate context' for the TCI) and the characteristics of the object studied.

Indeed, the inherent characteristics of health itself provoked some questions concerning the relationship between the SR objects and the methods used to uncover central elements (cf. Dany & Apostolidis, 2007). Health constitutes a quasi-paradigmatic object for examining the link between social and representational systems and understanding the connections between the 'biological' and 'social' orders (Herzlich, 1969). According to Herzlich (2001), 'our representations do not only tell us about the relationship with bodily phenomena and our own state of health, but also about relationships that through it, we maintain with others, with the world and the social order' (p. 198). Health contributes at the same time to individual, relational, identity, group, and societal issues. It is both a social value and a state (somatic, psychic, and social), being limited and measured as accurately as possible in order to make it an object of research and investigation (e.g., Apostolidis & Dany, 2012; Herzlich, 1969). From a socio-representational perspective, health is also a complex object because it seems that it cannot be understood without reference to other objects (e.g., illness, risk, body, society) that enable it to be expressed 'concretely' and help to give it its meaning (cf. Herzlich, 1969). It must be considered as a composite element of absence of illness, balance or homeostasis, function, and state or status (Blaxter, 2016). Health is a particularly effective field for the use and interchangeability of different types of knowledge (cf. Apostolidis & Dany, 2012; Legare & Gelman, 2008). Based on our results, and considering the complex nature of health, we can consider that health is an object of representations characterized both by its relative independence from the context (i.e., the TCI results), but also by its 'negotiable' aspect (i.e., the ACT results). In this perspective, it would seem that by relying on the relative independence of the central elements to

the context, the TCI is better adapted for studying objects of representations such as health.

However, these elements of discussion lead us to address various points at a theoretical-methodological level. (a) Results such as those obtained lead us to consider the need to develop knowledge concerning the adequacy between the object of representations and the methods of study of the structure. Indeed, although many studies have focused on the methodological aspect of the study of SRs, few have made the link between method and object the central reflection of their work. However, this brings us to a second consideration of a more theoretical nature. (b) Considering the adequacy between the method (which relied on particular characteristics of the central elements) and the object leads us to consider the possibility that the central elements of an object do not respond to all the properties supposed to characterize the central elements. However, to our knowledge, few studies have attempted to study the structure of the SR of an object using multiple tools (i.e., that rely on different properties of the central elements). This brings us to a third point. (c) To date, no tools have yet been developed to study the representational structure based on all the properties of the central elements. In other words, at this point, we do not have the possibility of knowing whether the central elements of a studied object respond to all the properties of the central elements.

To conclude, although the present study has produced these reflections, which seem to us to be relevant for the elaboration of methods and the theory of SRs, it does not however make it possible to answer them. It therefore seems fundamental to us that future work, both theoretical and methodological, should be carried out in order to extend them further. On a more global level, the theoretical-methodological issue of studying SRs refers substantially, but not exclusively, to the 'reality standing' of the representational structure. By 'reality standing', we refer to our capacity, through the appropriateness of the tools used, to obtain with precision and relevance the representational content present 'in vivo' when we carry out an empirical study. The correspondence between epistemological statement and data collection devices is a major issue for the development of the theory of SR.

Data Accessibility Statement

Raw data can be retrieved at: https://osf.io/ky2ca/?view_only=c079fdd3866a41119405ed21894dd448.

Note

- ¹ As a matter of fact, in France, worker status and public authorities have an impact on the type of effective access to a health insurance scheme. The type of occupation (e.g., agricultural worker, self-employed, military worker, job-seeker, student) determines the social security scheme to which the individual is affiliated that is to say the conditions of assistance concerning health problems (e.g., costs related to medical consultations, interventions and treatment), occupational accidents and diseases (compensation for victims), family (e.g., access to housing, financial assistance for

large families), and retirement (e.g., financial assistance for people with low income).

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Competing Interests

The authors have no competing interests to declare.

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