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Original article

# Assessing decision-making style in French-speaking populations: Translation and validation of the general decision-making style questionnaire☆

## *Évaluation des styles décisionnels dans les populations francophones : traduction et validation du « General Decision-Making Style Questionnaire »*

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ABSTRACT

*Introduction.* – Individual differences in decision-making are a fundamental component of our understanding of the decision-making process. Scott and Bruce (1995) developed the General Decision-Making Style (GDMS) questionnaire to assess five decision-making styles: rational, intuitive, dependent, avoidant, and spontaneous.
*Objective.* – The purpose of our study was to translate and validate the GDMS into French. This measure has been used frequently to assess decision-making style since its creation. Yet, the scale is currently unavailable in French despite being already available in Slovak, Italian, and Swedish.
*Method.* – Following best practices for scale translation (e.g., Vallerand, 1989), the original version of the GDMS was administered to a group of 345 English-speaking participants and the translated version of the questionnaire was administered to a group of 325 French-speaking participants.
*Results.* – The properties of the translated questionnaire were then compared to those of the original questionnaire. Results of item-level, scale-level and measurement invariance analyses demonstrate that the translated measure, the *Échelle des styles décisionnels*, is a valid and reliable assessment of decision-making style in French-speaking populations.
*Conclusion.* – This measure already exists in languages that are much less commonly spoken than French. The newly translated *Échelle des styles décisionnels* will now allow researchers to validly assess decision-making style in French-speaking populations, thereby greatly increasing the ability to assess cross-cultural stability of decision-making theories.


*Mots clés :*
Prise de décision
Styles décisionnels
Traduction en langue française
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RÉSUMÉ

*Introduction.* – Les différences individuelles dans la prise de décision sont une composante essentielle de notre compréhension du processus de prise de décision. Scott et Bruce (1995) ont développé le « General Decision-Making Style Questionnaire » (GDMS) afin d'évaluer cinq styles de prise de décision : rationnel, intuitif, dépendant, évitant et spontané.
*Objectif.* – Le but de notre étude était de traduire et valider le GDMS en français. Cette mesure a été fréquemment utilisée pour évaluer le style de prise de décision depuis sa création. Pourtant, l'échelle est actuellement indisponible en français en dépit d'être déjà disponible en slovaque, italien et suédois.

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*Méthode.* – Suivant les meilleures pratiques pour la traduction d'échelles (par exemple, Vallerand, 1989), la version originale du GDMS a été administrée à un groupe de 345 participants anglophones et la version traduite du questionnaire a été administrée à un groupe de 325 participants francophones.
*Résultats.* – Les propriétés de la traduction du questionnaire ont ensuite été comparées à ceux du questionnaire d'origine. Les résultats d'analyses au niveau des items, des sous-échelles et d'invariance au niveau de la mesure démontrent que la version traduite du GDMS, l'Échelle des styles décisionnels, est une mesure valable et fiable des styles de prise de décision dans les populations francophones.
*Conclusion.* – Le questionnaire GDMS existait déjà dans des langues qui sont beaucoup moins couramment parlées que le français. L'Échelle des styles décisionnels, maintenant disponible en français, permet dorénavant aux chercheurs d'évaluer valablement le style de prise de décision dans les populations francophones, ce qui augmente considérablement la capacité d'évaluer la stabilité interculturelle des théories de prise de décision.



Individual differences in decision-making are a fundamental component of our understanding of the decision-making process. Indeed, the study of how individual factors impact the process of making a decision is important and often overlooked aspect of judgment and decision-making research (Mohammed & Schwall, 2009). One interesting individual differences measure is Scott and Bruce's (1995) General Decision-Making Style (GDMS) questionnaire, which assesses an individual's patterned way of making decisions. This measure has been used frequently to assess decision-making style since its creation: as of October 2015, the original article in which it appeared has been cited over four hundred times according to Google Scholar. Yet, the scale is currently unavailable in French despite being already available in Slovak (Bavol'ár & Orosová, 2015), Italian (Gambetti, Fabbri, Bensi, & Tonetti, 2008), and Swedish (Thunholm, 2004).

As such, the purpose of our study was to translate the GDMS into French. Our goal was to ensure that the *Échelle des styles décisionnels* is a valid and reliable translation of the original GDMS questionnaire that can be used to measure decision-making styles in French-speaking populations. In particular, we go beyond typical translation efforts of item- and scale-level analyses on the newly translated measure by reporting measurement invariance (MI) analyses (Vandenberg & Lance, 2000), which help ascertain that the factor structure of the GDMS is equivalent in both languages.

Using MI analyses in linguistic translation of scales is an important step but one that is not often used. Indeed, authors either conduct exploratory and confirmatory factor analyses on the newly translated scale (e.g., Wagener & Blairy, 2015) or simply stop at the translation and back-translation of items (e.g., Bavol'ár & Orosová, 2015; Thunholm, 2004). Both approaches are not sufficiently rigorous, and methodologists are increasingly adopting MI analyses as a standard for evaluating measurement equivalence across groups (e.g., Schmitt & Kuljanin, 2008). In this sense, we hope that the present study will help promote the use of MI analyses in translation of scales. To this end, we strive to provide a step by step description of our methods and analyses so that interested readers can replicate them in their own work.

## 1. The GDMS

The GDMS assesses an individual's patterned way of making decisions along five dimensions: rational, intuitive, dependent, avoidant and spontaneous decision-making (Scott & Bruce, 1995). These five styles are developed by learning and habit. The rational style consists of thoroughly seeking and assessing alternative choices in a logical manner. The intuitive style corresponds to listening to one's gut feelings and instincts in order to make a decision. The dependent style consists of consulting others to get guidance and recommendations on how to decide. The avoidant style consists of making efforts to avoid the act of deciding. Finally, the spontaneous style corresponds to an individual's effort to make decisions as quickly as possible. Importantly, the five decision styles are not mutually exclusive; specifically, decision-makers can use a combination of these styles when they make a choice.

Since the publication of the GDMS, its versatility has been shown through its use in different decision contexts. For example, Curseu and Schruijer (2012) demonstrate that decision behaviors are predicted by decision styles. Specifically, they report that both the avoidant and the dependent styles are positively linked to indecisiveness, whereas the rational style is negatively linked to indecisiveness. In the context of advice taking, the dependent decision style is linked to more positive reactions to decision support and social support (Dalal & Bonaccio, 2010). In the context of education, the rational style is positively linked to higher school achievements whereas the spontaneous and avoidant styles are positively associated to the number of absences in school (Baiocco, Laghi, & D'Alessio, 2009). Other research has focused on how decision-making styles and well-being are related. For instance, the avoidant decision-making style is associated with lower satisfaction with life (Allwood & Salo, 2012). Both the avoidant and dependent styles are also linked to a greater tendency to experience stress (Allwood & Salo, 2012; Salo & Allwood, 2011) and lower emotional intelligence (Avsec, 2012).

## 2. The current study

The applications of the GDMS in current research illustrate how decision-making styles are an important part of individual differences in decision-making and how they are related to individual differences in overall well-being. By making the GDMS available in French, a greater number of researchers will have access to this measure and will therefore be able to contribute to the existing literature.

As described in the methods section, we translated the General Decision-Making Style Questionnaire developed by Scott and Bruce (1995). Following best practices for scale translation (e.g., Vallerand, 1989), the original version of the GDMS was administered to a group of English-speaking participants and the translated version of the questionnaire was administered to a group of French-speaking participants. We report several analyses that allow for the assessment of comparability across both linguistic versions. In addition to an analysis of the correspondence of item- and scale-level statistics, we also report formal measurement invariance (MI) analyses. MI is a confirmatory factor analysis (CFA) technique that permits researchers to determine whether a measure is functioning in the same way across groups, such as gender, age, or, as in the present case, language. Researchers can conclude that MI is present

in their data if the manifest random variable(s) (that is, the observed item or the scale scores) are a function of only the latent variables of interest (here, decision-making styles) and are conditionally independent from another (external) variable, such as language of the items (Mellenbergh, 1989; Meredith, 1993). Assessing MI when this external variable is categorical is often done via multi-group confirmatory factor (Vandenberg & Lance, 2000). If MI assumptions hold across groups, then researchers can employ the observed results drawn from the measures to make meaningful inferences about the constructs across groups of interests. For instance, finding that the GDMS is invariant across linguistic groups would enable researchers not only to compare participants drawn from French and English-speaking populations on their decision-making styles, but also in relation to other constructs such well-being indices.

## 3. Method

### 3.1. Samples

Our participants were enrolled in an introductory psychology course at a Canadian university. The French sample consisted of 325 undergraduate students. Most participants in the French sample were females (83.7%) between 18 and 20 years old (66.5%). The English sample consisted of 345 students. Most participants in the English sample were females (76.5%) between 18 and 20 years old (74.2%). Participants provided informed consent and the study protocol was approved by the relevant Institutional Review Board prior to undertaking the study.

### 3.2. Procedures and measures

Participants completed the questionnaire once in either French or English via a participant pool website in exchange for 1% credit compensation in their introductory psychology course.

#### 3.2.1. General Decision-Making Style Questionnaire

English participants responded to the original 25-item GDMS Questionnaire (Scott & Bruce, 1995). French participants completed the *Échelle des styles décisionnels (ESD)*, our translated version of the GDMS. The 25 items comprising each measure is shown in Table 1. Both measures used a 5-point Likert-type response scale that ranges from 1 (strongly disagree/*fortement en désaccord*) to 5 (strongly agree/*fortement en accord*).

The translation of the measure into French was conducted systematically (see Vallerand, 1989). Initially, the first author translated each item from the original GDMS into French. It was then back-translated by the third author, who did not have access to the original items. Both authors then examined the differences between the original and back-translated items. Eight item pairs were identical. The discrepancies between the remaining pairs were due to either verb tense [i.e. "when making decisions" vs. "when I make decisions" or the use of synonyms (i.e. "postpone" vs. "put off")]. After resolving these differences, a preliminary version of the French questionnaire was established.

This preliminary version was sent to two native French speakers to be evaluated for ease of readability and regional appropriateness. A native French-Canadian speaker currently living in Canada and a native French speaker currently living in France each looked at the French items and then compared them to the original English ones. They made minor suggestions for improvement in syntax. Based on these recommendations, the final version was established.

## 4. Results

### 4.1. Item-level analyses

The goal of a linguistic translation for any scale is to obtain a psychometrically parallel measure compared its original version. As such, our first set of analyses examined the level of consistency in three key item statistics: namely, item endorsement rate (item means), item variability (item standard deviations), and item discrimination (corrected item-total correlations). Ideally, a parallel measure will demonstrate the same pattern of item statistics compared to its original version. Evidence that the French items were faithfully translated will be seen by a strong correlation between the vectors of analogous item statistics (e.g., item means) from the French and English samples. Correlated vector analysis is commonly used in the psychology of individual differences literature to examine the correspondence of item or scale statistics (e.g., Reeve & Blacksmith, 2009; te Nijenhuis, van Vianen, & van der Flier, 2007).

The first step in our analysis was to focus on the item-level information. Results of item analyses are shown in the left half of Table 2. We started by examining item endorsement rates to ensure that the item statistics are consistent across versions. As shown in the first two columns of Table 2, most items for both the English and French version show item means near the mid-range of the 5-point scale, which is ideal for this type of measure. Endorsements close to the end points of the scale could be indicative of floor or ceiling effects, rendering the item less useful in the measure (Crocker & Algina, 2006). A few items (e.g., items 13, 16, 17) do show means greater than 4.0 which, given the 5-point scale, could be indicative of potential ceiling effects. However, this occurred in both linguistic versions of the measure, indicating a faithful translation.

We also tested for mean differences in the magnitudes of item endorsement rates. Because the measure is composed of 25 items, we applied a Bonferroni correction (where $p = .05/25 = .002$) to generate the appropriate significance level for the *t*-test for mean differences. Only two items (items 23 and 25) were found to have a significant difference (in both cases the French endorsement rate was higher). This suggests that, as a set, the translated items were not endorsed with a greater or lesser magnitude than the original English items. However, because our design includes respondents from two linguistic groups, one should not assume equal latent means or latent variability across groups a priori. Thus, a correlated vectors approach provides more meaningful information regarding the equivalency of items across forms than the comparison of observed item means. That is, even if one group has a higher average than the other, the rank-order of item endorsement rates across items should be consistent. The correlation for endorsement rates between the linguistic groups was $r = .99$. This confirms that, within each linguistic group, the item endorsement rates display the same rank-ordering and relative differences across the 25 items.

Second, we repeated the analysis on item variability. Again, ideally one would see reasonable levels of variability on each item, and importantly, the same relative pattern of differences in item variability across linguistic groups. As shown in Table 2, most of the items show standard deviations near 1.0, which given the 5-point scale, suggests these items are not suffering from limited variation. Furthermore, the vector correlation for item standard deviations is $r = .90$, indicating a very strong degree of convergence across the linguistic groups. Within each linguistic group, the item variability display largely similar rank-ordering and relative differences across the 25 items.

Third, we examined item discrimination, which indicate the degree to which the individual item can differentiate among respondents. This analysis uses the corrected item-total correlation ($r_{it}$) as a criterion. Traditionally $r_{it} > .20$ has been used as a general guide for screening items (Throndike & Thorndike-Christ, 2010).

**Table 1**
English and French items.

| Items | The General Decision-Making Style Questionnaire | *Échelle des styles décisionnels* |
|---|---|---|
| Rational subscale | | |
| 1 | I double-check my information sources to be sure I have the right facts before making decisions | *Je vérifie une seconde fois mes sources d'informations afin de m'assurer d'avoir les bons faits avant de prendre des décisions* |
| 6 | I make decisions in a logical and systematic way | *Je prends des décisions de manière logique et systématique* |
| 11 | My decision making requires careful thought | *Ma prise de décision requiert une réflexion attentive* |
| 16 | When making a decision, I consider various options in terms of a specific goal | *Quand je prends une décision, je considère diverses options en fonction d'un but spécifique* |
| 21 | I usually have a rational basis for making a decision | *Je base habituellement mes décisions sur des fondements rationnels* |
| Intuitive subscale | | |
| 2 | When making decisions, I rely upon my instincts | *Quand je prends des décisions, je me fie à mes instincts* |
| 7 | When I make decisions, I tend to rely on my intuition | *Quand je prends des décisions, j'ai tendance à me fier à mon intuition* |
| 12 | When I make a decision, it is more important for me to feel the decision is right than to have a rational reason for it | *Quand je prends une décision, il m'est plus important de ressentir que c'est une bonne décision que d'avoir une raison rationnelle pour celle-ci* |
| 17 | I generally make decisions that feel right to me | *Je prends généralement des décisions que je ressens comme étant les bonnes* |
| 22 | When I make a decision, I trust my inner feelings and reactions | *Quand je prends une décision, je fais confiance à mes sentiments et réactions* |
| Dependent subscale | | |
| 3 | I often need the assistance of other people when making important decisions | *J'ai souvent besoin de l'assistance des autres pour prendre des décisions importantes* |
| 8 | I rarely make important decisions without consulting other people | *Je prends rarement des décisions importantes sans consulter d'autres personnes* |
| 13 | If I have the support of others, it is easier for me to make important decisions | *Si j'ai le soutien des autres, il est plus facile pour moi de prendre des décisions importantes* |
| 18 | I use the advice of other people in making my important decisions | *J'utilise les conseils des autres quand je prends des décisions importantes* |
| 23 | I like to have someone to steer me in the right direction when I am faced with important decisions | *J'aime que l'on m'oriente dans la bonne direction quand je fais face à des décisions importantes* |
| Avoidant subscale | | |
| 4 | I avoid making important decisions until the pressure is on | *J'évite de prendre des décisions importantes jusqu'à ce que je ressente de la pression pour le faire* |
| 9 | I postpone decision making whenever possible | *Je repousse la prise de décision quand il est possible* |
| 14 | I often procrastinate when it comes to making important decisions | *Je remets souvent les décisions importantes à plus tard* |
| 19 | I generally make important decisions at the last minute | *Je prends généralement des décisions importantes à la dernière minute* |
| 24 | I put off making many decisions because thinking about them makes me uneasy | *Je remets à plus tard plusieurs de mes décisions car je me sens angoissé(e) lorsque j'y pense* |
| Spontaneous subscale | | |
| 5 | I generally make snap decisions | *Je prends généralement des décisions de façon soudaine* |
| 10 | I often make decisions on the spur of the moment | *Je prends souvent des décisions sur le coup* |
| 15 | I make quick decisions | *Je prends des décisions rapidement* |
| 20 | I often make impulsive decisions | *Je prends souvent des décisions impulsives* |
| 25 | When making decisions, I do what seems natural at the moment | *Quand je prends des décisions, je fais ce qui me semble naturel à ce moment-là* |

Items in English are from Scott and Bruce (1995). The 5-point Likert-type scale, ranging from 1 (strongly disagree/*fortement en désaccord*) to 5 (strongly agree/*fortement en accord*).

Because this statistic requires unidimensionality in the set of items, we conducted this analysis at the subscale-level (i.e., the "total" score used in the correlation is the score only for the associated subscale, with the focal item removed). Shown in the columns at the top right of Table 2, both the original English items and the French items all show item-total correlations above .20. Furthermore, the vector correlation for the item discrimination statistic is $r = .90$, indicating a very strong degree of convergence across linguistic versions. Within each linguistic group, the item-total correlations display largely similar rank-ordering and relative differences in across the 25 items.

Taken together, all three of the prior analyses indicate that the French items appear to function largely in parallel with the English items. That is, while the absolute value of each pair of item statistics may not be identical across groups (e.g., means of item 1 for French and English respondents), the set of items demonstrate the same relative pattern of differences in item statistics. This shows that across linguistic groups, the most (least) favored items, the most (least) variable items, and the most (least) discriminating items tend to be the same across the English and French versions of the measure.

Next, we submitted the items to an exploratory factor analysis. Although we had a priori planned for confirmatory factor analyses (the measurement invariance analysis reported below), we thought it proper to examine convergence of the factor structure across linguistic groups prior to placing any assumptions on the model. As such, we submitted each dataset to an exploratory factor analysis (EFA) with maximum likelihood as the extraction method and an oblique (Oblimin) rotation. The standardized pattern matrix for both linguistic groups is shown in the bottom panel of Table 2. As shown, both measures display the expected 5-factor pattern with the expected simple solution for the most part (i.e., items loading saliently on only their intended factor). Interestingly, in both versions of the measure, item 25 loads inappropriately in the same fashion, loading saliently on the Intuitive factor rather than the Spontaneous factor. Although this suggests there may be a problem with the original English language item, it does indicate the translation process was faithful. Furthermore, Loo (2000) also reported a salient cross loading for this item (labelled item 20 in Loo's Table 3). Thus, our French translation is showing similar patterns of results with the English measure in our sample and in prior work. It should be noted that item 12 failed to load saliently on any factor in the

**Table 2**
Item-level descriptive statistics.

| Items | Means | | *SD*s | | $r_{it}$ | |
|---|---|---|---|---|---|---|
| | French | English | French | English | French | English |
| Rational subscale | | | | | | |
| Item 1 | 3.91 | 3.96 | 0.89 | 0.89 | .30 | .26 |
| Item 6 | 3.90 | 3.81 | 0.69 | 0.83 | .49 | .47 |
| Item 11 | 4.01 | 3.90 | 0.72 | 0.82 | .45 | .48 |
| Item 16 | 4.08 | 4.04 | 0.63 | 0.74 | .45 | .49 |
| Item 21 | 3.74 | 3.83 | 0.75 | 0.76 | .35 | .42 |
| Intuitive subscale | | | | | | |
| Item 2 | 3.76 | 3.72 | 0.79 | 0.77 | .55 | .46 |
| Item 7 | 3.66 | 3.60 | 0.82 | 0.79 | .55 | .55 |
| Item 12 | 3.61 | 3.49 | 0.91 | 1.00 | .29 | .35 |
| Item 17 | 4.01 | 4.06 | 0.66 | 0.66 | .42 | .40 |
| Item 22 | 3.69 | 3.81 | 0.78 | 0.73 | .50 | .49 |
| Dependent subscale | | | | | | |
| Item 3 | 3.46 | 3.64 | 1.11 | 1.09 | .60 | .62 |
| Item 8 | 3.65 | 3.60 | 1.00 | 1.12 | .64 | .50 |
| Item 13 | 4.08 | 4.22 | 0.90 | 0.81 | .54 | .48 |
| Item 18 | 3.94 | 3.91 | 0.74 | 0.76 | .54 | .58 |
| Item 23 | 3.93 | 3.62* | 0.90 | 0.91 | .61 | .57 |
| Avoidant subscale | | | | | | |
| Item 4 | 2.86 | 2.82 | 1.10 | 1.10 | .68 | .67 |
| Item 9 | 3.02 | 2.93 | 1.05 | 1.11 | .72 | .73 |
| Item 14 | 2.85 | 3.09 | 1.06 | 1.13 | .79 | .77 |
| Item 19 | 2.50 | 2.48 | 0.99 | 1.03 | .47 | .63 |
| Item 24 | 2.95 | 2.92 | 1.14 | 1.17 | .72 | .68 |
| Spontaneous subscale | | | | | | |
| Item 5 | 2.71 | 2.58 | 1.00 | 0.91 | .70 | .61 |
| Item 10 | 2.71 | 2.67 | 1.01 | 0.93 | .74 | .70 |
| Item 15 | 2.65 | 2.65 | 0.91 | 0.97 | .61 | .54 |
| Item 20 | 2.52 | 2.54 | 0.92 | 0.99 | .66 | .56 |
| Item 25 | 3.58 | 3.36* | 0.78 | 0.87 | .35 | .32 |
| VC *r* = | | .99 | | .90 | | .90 |

| Items | EFA factor loadings | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | French | | | | | English | | | | |
| | Rational | Intuitive | Dependent | Avoidant | Spontaneous | Rational | Intuitive | Dependent | Avoidant | Spontaneous |
| Rational subscale | | | | | | | | | | |
| Item 1 | .39 | | | | | .35 | | | | |
| Item 6 | .56 | | | | | .57 | | | | |
| Item 11 | .58 | | | | | .51 | | | | |
| Item 16 | .60 | | | | | .59 | | | | |
| Item 21 | .47 | | | | | .57 | | | | |
| Intuitive subscale | | | | | | | | | | |
| Item 2 | | .82 | | | | | .64 | | | |
| Item 7 | | .84 | | | | | .78 | | | |
| Item 12 | | | | | | | .37 | | | |
| Item 17 | | .39 | | | | | .46 | | | |
| Item 22 | | .52 | | | | | .58 | | | |
| Dependent subscale | | | | | | | | | | |
| Item 3 | | | .64 | | | | | .72 | | |
| Item 8 | | | .71 | | | | | .55 | | |
| Item 13 | | | .61 | | | | | .59 | | |
| Item 18 | | | .56 | | | | | .68 | | |
| Item 23 | | | .73 | | | | | .66 | | |
| Avoidant subscale | | | | | | | | | | |
| Item 4 | | | | .66 | | | | | .71 | |
| Item 9 | | | | .80 | | | | | .84 | |
| Item 14 | | | | .90 | | | | | .85 | |
| Item 19 | | | | .47 | | | | | .69 | |
| Item 24 | | | | .82 | | | | | .70 | |
| Spontaneous subscale | | | | | | | | | | |
| Item 5 | | | | | .83 | | | | | .66 |
| Item 10 | | | | | .83 | | | | | .78 |
| Item 15 | | | | | .60 | | | | | .62 |
| Item 20 | | | | | .74 | | | | | .58 |
| Item 25 | | .34 | | | | | .50 | | | |
| VC *r* = | | | | | | | | | | |

English sample $n = 345$; French sample $n = 325$. $r_{it}$: corrected item-total correlation; VC *r*: vector correlation of corresponding French and English statistics.

* Difference significant at $p < .002$ (we applied the Bonferroni correction where the *p*-value was adjusted for the number of comparisons, i.e., $p = .05/25 = .002$). Factor loadings < .30 are not shown.

**Table 3**
Cronbach's alphas for the English and French versions of the GDMS.

| | Range from Scott and Bruce (1995) | Range of published reliabilities | French sample | English sample |
|---|---|---|---|---|
| Rational | .77–.85 | .58–.83 | .66 | .66 |
| Intuitive | .78–.84 | .72–.80 | .70 | .70 |
| Dependent | .68–.86 | .62–.84 | .80 | .77 |
| Avoidant | .93–.94 | .84–.87 | .86 | .87 |
| Spontaneous | .87 | .69–.84 | .81 | .77 |

Scott and Bruce (1995) only included the spontaneous subscale in one sample; hence, no reliability range is available.

French sample and similarly had the lowest loading in the English sample for the Intuitive factor.

### 4.2. Scale-level analyses

After having ascertained that the French and English versions of the GDMS showed proper correspondence at the item-level, we can now look at scale-level properties. To this end, we examined the correspondence of internal consistency reliability estimates across linguistic groups. It was important to demonstrate that (a) the individual subscales show adequate internal consistency within the French version, and (b) that they are in the same range as those seen in previously published work. Shown in Table 3, the five alpha estimates are quite similar across the current English and French samples. For both, the rational scale shows the lowest internal reliability estimate and the avoidant scale shows the highest. All of the observed alpha estimates for each subscale from the current study fall within the range of recently published reliabilities (see Allwood & Salo, 2012; Baiocco et al., 2009; Bavol'ár & Orosová, 2015; Curseu & Schruijer, 2012; Gambetti et al., 2008; Loo, 2000; Salo & Allwood, 2011; Spicer & Sadler-Smith, 2005; Wood & Highhouse, 2014). The relatively low alpha estimates for the rational and intuitive scales do raise some limited concerns; however, it is important to recall that for the purpose of translation, we wish to show that the alpha values are consistent across the English and French groups. Moreover, these values are consistent with recent uses of the GDMS (e.g., Allwood & Salo, 2012; Salo & Allwood, 2011). Thus, taken as a whole, these results again confirm that the translation process was successful; the French version of the measure functions the same as the English version.

Finally, we examined the pattern of correlations among the five subscales. The pattern of inter-scale correlations, displayed in Table 4, is quite similar across the English and French groups. For example, for both linguistic groups, rational scores are essentially unrelated to intuitive and dependent scores and have moderate negative relations with avoidant and spontaneous scores. Similarly, intuitive is essentially unrelated to dependent and avoidant, and shows a moderate to large positive association with spontaneous scores in both linguistic groups. Likewise, dependent scores show significant positive associations with avoidant scores, and negative associations with spontaneous scores. Although the absolute magnitudes of the correlations vary somewhat across groups, the overall pattern of relations among the subscales is consistent, once again indicating the translation process lead to the creation scales that function in parallel to the English version.

**Table 4**
Correlations between the GDMS/ESD subscales.

| Variable | Rational | Intuitive | Dependent | Avoidant |
|---|---|---|---|---|
| English sample | | | | |
| Rational | | | | |
| Intuitive | −.06 | | | |
| Dependent | .08 | −.01 | | |
| Avoidant | −.22** | .04 | .18** | |
| Spontaneous | −.39** | .31** | −.16** | .14* |
| French sample | | | | |
| Rational | | | | |
| Intuitive | −.08 | | | |
| Dependent | .02 | .04 | | |
| Avoidant | −.21** | .02 | .37** | |
| Spontaneous | −.27** | .41** | −.21** | .03 |

English sample $n = 345$; French Sample $n = 325$.
* $p < 0.05$ level.
** $p < 0.01$ level.

### 4.3. Measurement invariance analyses

We used AMOS to perform structural equation modeling analyses through maximum likelihood estimation and we used raw data as input for all analyses. Following Vandenberg and Lance (2000), we report the results of tests of configural, metric and scalar invariance, which complete the invariance tests for the measurement model. Additional tests are sometimes conducted in evaluations of MI. These are tests of invariant uniquenesses, factor variances, factor covariances, and factor means (Vandenberg & Lance, 2000). However, when "one's interest is in the comparison of observed mean differences between groups, then demonstrations of metric and scalar invariance are critical and sufficient" (Schmitt & Kuljanin, 2008, p. 214).

Overall model fit was assessed according to several indices. Following Vandenberg and Lance (2000), we employ the Chi-square ($\chi^2$) statistic, and the $\chi^2$/degrees of freedom ratio, as it improves the sensitivity of the $\chi^2$ index toward sample size (Wheaton, Muthén, Alwin & Summers, 1977). It is common practice to use these indices along with other fit indices (Bollen & Long, 1993), such as the root mean square error of approximation (RMSEA), the Tucker–Lewis index (TLI), and the comparative fit index (CFI). RMSEA values under .05 represent good fit, and values of .08 are the upper bound for acceptable fit (Browne & Cudeck, 1992). For TLI and CFI, values that meet or exceed the .95 threshold are considered indicative of good fit, and .90 is the lower bound for adequate fit (Hu & Bentler, 1999).

To conduct the analysis, it is proper to first establish a good fitting model in each group independently. In this process, the standard model did not achieve acceptable fit in either group. Analysis of the mis-fit suggested that, as indicated by the EFA report above, item 25 did not function as expected in either group (English sample: $\chi^2 = 654.70$, TLI = .834, CFI = .854, RMSEA = .065; French sample: $\chi^2 = 647.61$, TLI = .846, CFI = .864, RMSEA = .067). Importantly, the model was equally ill fitting in both languages, indicating we faithfully translated the original items. Still, we removed item 25 from the model for the purpose of the MI analyses.

As shown in the first two lines of Table 5, the model for both linguistic groups had acceptable fit based on the $\chi^2$/df, and RMSEA, with the values for the TLI and CFI being reasonable, but not surpassing the standard thresholds. While the TLI and CFI are not optimal, this appears to be the standard level of fit for the GDMS instrument. Indeed, our CFA results are consistent with other independent evaluations of the GDMS (see Loo, 2000; Spicer & Sadler-Smith, 2005; Curseu & Schruijer, 2012). Based on finding adequate fit of the model in both linguistic groups that is consistent with prior research, we accepted the model as appropriate for the MI analyses.

**Table 5**
Measurement invariance results across linguistic groups (item 25 omitted).

| Model | $\chi^2$ | df | $\chi^2$/df | TLI | CFI | RMSEA | RMSEA 90% CI | | ΔdF | ΔTLI | ΔCFI | ΔRMSEA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper | | | | |
| CFA – English | 560.426 | 242 | 2.316 | .858 | .875 | .062 | .055 | .069 | – | – | – | – |
| CFA – French | 559.889 | 242 | 2.314 | .866 | .883 | .064 | .057 | .071 | – | – | – | – |
| 1. Configural invariance | 1120.318 | 484 | 2.315 | .862 | .879 | .044 | .041 | .048 | – | – | – | – |
| 2. Metric invariance | 1152.546 | 503 | 2.291 | .865 | .877 | .044 | .041 | .047 | – | – | – | – |
| 1 versus 2 | – | – | – | – | – | – | – | – | 19 | –.003 | .002 | .000 |
| 3. Scalar invariance | 1267.369 | 527 | 2.405 | .853 | .859 | .046 | .043 | .049 | – | – | – | – |
| 2 versus 3 | – | – | – | – | – | – | – | – | 24 | .012 | .018 | .002 |
| 4. Residual invariance | 1337.002 | 551 | 2.427 | .850 | .851 | .046 | .043 | .049 | – | – | – | – |
| 3 versus 4 | – | – | – | – | – | – | – | – | 24 | .002 | .008 | .000 |

RMSEA: root mean square error of approximation; TLI: Tucker–Lewis index; CFI: comparative fit index. Using model with item 25 omitted.

We first tested for configural invariance, which restricts the factor loading pattern, but not the loading themselves, to be invariant between groups. As can be seen in Table 5, the overall fit for the multi-group analysis requiring configural invariance is acceptable (the larger sample size of the combined sample explaining the slight improvement in fit from the independent models). Next, we carried out the test of metric invariance, which require constraining the unstandardized factor loadings to be invariant between groups. Again, the model shows good overall fit, with the reduction in fit from the less constrained model being non-significant. Specifically, the reduction in magnitude of the RMSEA and CFI are below the recommended criteria for rejecting the hypothesis of invariance (i.e., ΔRMSEA < .015 and ΔCFI < .01; Chen, 2007). Next, we carried out the test for scalar invariance, which is done by constraining item intercepts to be equal between linguistic groups (while retaining the previous model constraints as well). In this case, the model fit becomes less clear. The ΔRMSEA is less than .015 indicating the added constraints do not appreciably reduce the model fit. However, the CFI did show a change slightly greater than .01. Given the mixed result, we continued ahead with the fourth restriction (constraining the uniqueness terms to be equivalent across groups) to provide a tentative examination of that assumption. As shown in the final two lines of Table 5, this additional constraint does not further reduce the model fit. This indicates that the observed variance in analogous items across linguistic groups stems from the same ratio of common to unique variance. Based on the full set of MI analyses, the results suggest the psychometric functioning of the French-language version of the GDMS is largely invariant with respect to the original English version. This conclusion comes with the caveat that item 25 does not appear to function (in both French and English samples) as designed in Scott and Bruce's (1995) original version of the scale and was not included in the MI analyses.

## 5. Discussion

In recent years, there has been a growing interest in understanding individual differences in decision making (see Mohammed & Schwall, 2009). As these authors argue, investigating decision-making individual differences is complementary to the traditional study of task-related and environmental-related factors that exert influences on decision makers. The rational, intuitive, dependent, avoidant, and spontaneous styles are examples of decision-making individual differences that allow us to better understand how individuals approach decisions (e.g., Curseu & Schruijer, 2012), and what the decision outcomes may be (e.g., Baiocco et al., 2009). Furthermore, decision-making styles also provide a unique lens to understand overall well-being (e.g., Allwood & Salo, 2012). Expanding the measurement of decision-making styles to languages other than English is thus a worthwhile initiative.

The goal of our study was to translate Scott and Bruce's (1995) General Decision-Making Style Questionnaire into French. This measure already exists in languages that are much less commonly spoken than French – Slovak (Bavol'ár & Orosová, 2015), Italian (Gambetti et al., 2008), and Swedish (Thunholm, 2004). The *Échelle des styles décisionnels* will now allow researchers to validly assess decision-making style in French-speaking populations, thereby increasing the ability to assess cross-cultural stability of decision-making theories.

We demonstrate that the translated measure, the *Échelle des styles décisionnels*, functions in parallel to the original measure, the General Decision-Making Style questionnaire. We do so by analyzing data from two samples of respondents, one responding to the original measure in English, and one responding to the translated measure in French. We show that the measures have equivalent psychometric properties by first conducting item-level and scale-level analyses. The results demonstrate that the measures behave in similar fashions across languages, even to the point of exhibiting the same specific psychometric concerns known to exist with the GDMS. For example, the low Cronbach's alpha for the rational subscale, or the slightly ill-fitting CFA, are equally so for both linguistic samples, and are consistent with prior psychometric analyses of the GDMS. Following the item- and scale-level analyses, we conduct measurement invariance analyses, which support the hypotheses of configural, metric, scalar and residual invariance across linguistic versions of the measure. Given the overall pattern of results across these item-level, scale-level and MI analyses, we can confidently conclude that the *Échelle des styles décisionnels* is a faithful translation of the General Decision-Making Style questionnaire published by Scott and Bruce (1995).

In addition to providing the results of our scale translation efforts, our intention was to demonstrate the utility of using comparative analyses based on data gathered in both languages to determine whether the translated version of the measure is equivalent to its original, English version. Indeed, many researchers will diligently translate and back translate the questionnaire and conduct item-level analyses to demonstrate the success of the translation (e.g., Bavol'ár & Orosová, 2015; Thunholm, 2004). Many researchers also rely on CFA for data gathered via the newly translated scale in its new language only (e.g., Wagener & Blairy, 2015). While this approach is a significant improvement over the simple back-translation of items, and indeed, was endorsed by Vallerand (1989), it is important to continue the evaluation of the translation through MI analyses, which have become more common since Vallerand's original guidelines were published. Indeed, MI analyses are becoming the gold standard when the goal is to compare a measure across groups (Vandenberg & Lance, 2000).

Thus, we encourage researchers to collect data on the measure in its original language in addition to its newly translated form. This approach has several advantages, most notably the

opportunity of finding the source of any potential problem that may exist with the translation. For example, in our EFA, we show that item 25 demonstrated cross loadings in the French version of the measure. By demonstrating the same cross loading in our English sample (and finding that past research had also reported similar cross loading issues; Loo, 2000), we can demonstrate that the cross loading in our French sample is not due to our translation of items. An EFA or a CFA on data drawn from only a French sample of respondents would not permit this finding and, indeed, one would question the factor structure of the translation. Conducting MI analyses to complement the CFA analyses conducted on both linguistic groups separately further helps researchers pinpoint the source of variance between the translation and the original version, if variance exists. For example, if the original and translated measures show issues when testing for metric invariance, this would mean the scale items load on the latent factors to a different degree across linguistic groups. This finding could have implications for the comparability of the measure across linguistic groups. We refer readers to the Vandenberg and Lance (2000) excellent tutorial on MI and we hope that the present study will encourage more researchers to use MI in translation of measures.

We also note that we enlisted the help of a French speaker from Canada (specifically, from the French-speaking Province of Québec) as well as one from France to help refine our translation. An even more stringent approach would have been to carry out the analyses across three samples: English-Canada, French-Canada, French-France, as suggested by a reviewer. That we did not is a limitation of our approach. Therefore, we encourage users of the ESD with non French-Canadian samples to keep in mind that the validation work for the translation was conducted using French-Canadian respondents. Still, when one is interested in translating scales toward a language that is spoken in multiple parts of the world, such as French, English and Spanish, validating a translation using only a single form of a language is a common limitation (see for example, Sexton & Dugas, 2008; Romero, Villar, Gómez-Fraguela, & López-Romero, 2012). Studying the use of a scale or the construct it measures in multiple samples across the world is a worthwhile initiative as it allows to explore cross-cultural similarities and variations (e.g., Brown, Harris, O'Quin, & Lane, 2015).

In conclusion, the *Échelle des styles décisionnels* can be used by researchers who wish to assess decision-making style in French-speaking populations, as it is a faithful translation of Scott and Bruce's General Decision-Making Style (1995) questionnaire. With most decision-making research being conducted in English, few validated questionnaires exist in other languages, such as French. As a result, the unavailability of measures in different languages considerably limits the study of non-English populations. Questionnaire translation is a good way to tackle this issue, as it provides greater access to measures, allowing for different researchers to put their own mark in the literature. Moreover, by having equivalent measures in multiple languages, we can more confidently aggregate findings across an international literature.

## Disclosure of interest

The authors declare that they have no competing interest.

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## References

Allwood, C. M., & Salo, I. (2012). Decision-making styles and stress. *International Journal of Stress Management*, *19*(1), 34–47. http://dx.doi.org/10.1037/a0027420

Avsec, A. (2012). Do emotionally intelligent individuals use more adaptive decision-making styles? *Studia Psychologica*, *54*(3), 209–220. http://www.psychologia.sav.sk/sp/index.php?id=abstract&numid=607

Baiocco, R., Laghi, F., & D'Alessio, M. (2009). Decision-making style among adolescents: Relationship with sensation seeking and locus of control. *Journal of Adolescence*, *32*, 963–976. http://dx.doi.org/10.1016/j.adolescence.2008.08.003

Bavol'ár, J., & Orosová, O. (2015). Decision-making styles and their associations with decision-making competencies and mental health. Judgment and Decision Making. *10*, 115–122. http://www.journal.sjdm.org/14/141103/jdm141103.html

Bollen, K. A., & Long, J. S. (1993). *Testing structural equation models*. Newbury Park, CA: Sage.

Brown, G. T. L., Harris, L. R., O'Quin, C., & Lane, K. E. (2015). Using multigroup confirmatory factor analysis to evaluate cross-cultural research: Identifying and understanding non-invariance. *International Journal of Research & Method in Education. Advance online publication*, http://dx.doi.org/10.1080/1743727X. 2015.1070823

Browne, M. W., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological Methods and Research*, *21*, 230–258. http://dx.doi.org/10.1177/0049124192021002005

Chen, F. F. (2007). Sensitivity of goodness of fit indices to lack of measurement invariance. *Structural Equation Modeling*, *14*(3), 464–504. http://dx.doi.org/10.1080/10705510701301834

Crocker, L., & Algina, J. (2006). *Introduction to classical and modern test theory*. Belmont, CA: Wadsworth Publishing.

Curseu, P. L., & Schruijer, S. G. L. (2012). Decision styles and rationality: An analysis of the predictive validity of the general decision-making style inventory. *Educational and Psychological Measurement*, *72*(6), 1053–1062. http://dx.doi.org/10.1177/0013164412448066

Dalal, R. S., & Bonaccio, S. (2010). What types of advice do decision-makers prefer? *Organizational Behavior and Human Decision Processes*, *112*, 11–23. http://dx.doi.org/10.1016/j.obhdp.2009.11.007

Gambetti, E., Fabbri, M., Bensi, L., & Tonetti, L. (2008). A contribution to the Italian validation of the General Decision-making Style Inventory. *Personality and Individual Differences*, *44*(4), 842–852. http://dx.doi.org/10.1016/j.paid.2007.10.017

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55. http://dx.doi.org/10.1080/10705519909540118

Loo, R. (2000). A psychometric evaluation of the General Decision-Making Style Inventory. *Personality and Individual Differences*, *29*, 895–905. http://dx.doi.org/10.1016/S0191-8869(99)00241-X

Mellenbergh, G. J. (1989). Item bias and item response theory. *International Journal of Educational Research*, *13*, 127–143. http://dx.doi.org/10.1016/0883-0355(89)90002-5

Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika*, *58*, 525–543. http://dx.doi.org/10.1007/BF02294825

Mohammed, S., & Schwall, A. (2009). Individual differences and decision making: What we know and where do we go from here? In G. P. Hodgkinson, & J. K. Ford (Eds.), *International review of industrial and organizational psychology* (24) (pp. 249–312). Wiley-Blackwell: Chichester, West Sussex, UK.

Reeve, C. L., & Blacksmith, N. (2009). Equivalency and reliability of vectors of g-loadings across different methods of estimation and sample sizes. *Personality and Individual Differences*, *47*, 968–972. http://dx.doi.org/10.1016/j.paid.2009.07.025

Romero, E., Villar, P., Gómez-Fraguela, J. A., & López-Romero, L. (2012). Measuring personality traits with ultra-short scales: A study of the Ten Item Personality Inventory (TIPI) in a Spanish sample. Personality and Individual Differences. *53*, 289–293. http://dx.doi.org/10.1016/j.paid.2012.03.035

Salo, I., & Allwood, C. M. (2011). Decision-making styles, stress and gender among investigators. *Policing: An International Journal of Police Strategies & Management*, *34*(1), 97–119. http://dx.doi.org/10.1108/13639511111106632

Schmitt, N., & Kuljanin, G. (2008). Measurement invariance: Review of practice and implications. *Human Resource Management Review*, *18*, 210–222. http://dx.doi.org/10.1016/j.hrmr.2008.03.003

Scott, S. G., & Bruce, R. A. (1995). Decision-making style: The development and assessment of a new measure. *Educational and Psychological Measurement*, *55*, 818–831. http://dx.doi.org/10.1177/0013164495055005017

Sexton, K. A., & Dugas, M. J. (2008). The Cognitive Avoidance Questionnaire: Validation of the English translation. *Journal of Anxiety Disorders*, *22*, 355–370. http://dx.doi.org/10.1016/j.janxdis.2007.04.005

Spicer, D. P., & Sadler-Smith, E. (2005). An examination of the general decision-making style questionnaire in two UK samples. *Journal of Managerial Psychology*, *20*(2), 137–149. http://dx.doi.org/10.1108/02683940510579777

Nijenhuis, te. J., van Vianen, A. E. M., & van der Flier, H. (2007). Score gains on g-loaded tests: No g. *Intelligence*, *35*, 283–300. http://dx.doi.org/10.1016/j.intell.2006.07.006

Throndike, R. M., & Thorndike-Christ, T. (2010). *Measurement and evaluation in psychology and education* (8th ed.). Boston, MA: Pearson.

Thunholm, P. (2004). Decision-making style: Habit, style or both? *Personality and Individual Differences*, *36*, 931–944. http://dx.doi.org/10.1016/S0191-8869(03)00162-4

Vallerand, R. J. (1989). Vers une méthodologie de validation trans-culturelle de questionnaires psychologiques : implications pour la recherche en

langue française [Toward a methodology for the transcultural validation of psychological questionnaires: Implications for research in the French language]. *Canadian Psychology/Psychologie canadienne*, *30*(4), 662–680. http://dx.doi.org/10.1037/h0079856

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*, *3*, 4–70. http://dx.doi.org/10.1177/109442810031002

Wagener, A., & Blairy, B. (2015). Version française de la Distress Tolerance Scale et de la Discomfort Intolerance Scale [French versions of the Distress Tolerance Scale and the Discomfort Intolerance Scale]. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, *47*, 241–250. http://dx.doi.org/10.1037/cbs0000015

Wheaton, B., Muthén, B., Alwin, D., & Summers, G. (1977). Assessing reliability and stability in panel models. In D. R. Heise (Ed.), *Sociological methodology* (pp. 84–136). San Francisco: Jossey-Bass, Inc.

Wood, N. L., & Highhouse, S. (2014). Do self-reported decision styles relate with others' impressions of decision quality? *Personality and Individual Differences*, *70*, 224–228. http://dx.doi.org/10.1016/j.paid.2014.06.036