2nd European-Portuguese version of CAPE-V: Psychometric characteristics

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Gail B. Kempster

University College London
28th & 29th March 2017
II. REVIEW OF THE LITERATURE
I. REVIEW OF THE LITERATURE

• Auditory-perceptual evaluation:

  ▪ "Golden standard" for documenting voice disorders;
  ▪ Non-invasive, thus comfortable to the patient;
  ▪ Succinct, quick to perform, and low cost.

Carding et al. (2000)
Carding, Wilson, MacKenzie & Deary (2009)
Oates (2009)
Sáenz-Lechón et al. (2006)
Speyer (2008)
• Auditory-perceptual evaluation:

  ▪ “Golden standard” for documenting voice disorders;
  ▪ Non-invasive, thus comfortable to the patient;
  ▪ Succinct, quick to perform, and low cost.

Used worldwide

Carding et al. (2000)
Carding, Wilson, MacKenzie & Deary (2009)
Oates (2009)
Sáenz-Lechón et al. (2006)
Speyer (2008)
• Auditory-perceptual evaluation:
  
  ▪ Usually considered to be subjective;
  ▪ Influenced by several factors:
    ▪ Listener’s standards;
    ▪ Voice stimuli;
    ▪ Type of rating scale.

Kreiman et al. (1990)  Zraick et al. (2005)

Font: The scientific parente, 2015
I. REVIEW OF THE LITERATURE

- **CAPE-V**: ASHA (2006)
- **(I)INFVo**: Moerman et al. (2006)
- **SVEA**: Hammarberg (2000)
- **GIRBAS**: Dejonckere et al. (1996)
- **GRABASH**: Nerm & Lehn (2010)
- **VPAS**: Laver et al. (1981)
- **GRBAS**: Hirano (1981)
- **RASAT**: Pinho & Pontes (2002)
- **RASATI**: Pinho & Pontes (2008)
- **Buffalo III VP**: Wilson (1987)
I. REVIEW OF THE LITERATURE

- **CAPE-V** (ASHA (2006))
- **(I)INFVo** (Moerman et al. (2006))
- **SVEA** (Hammarberg (2000))
- **GIRBAS** (Dejonckere et al. (1996))
- **GRABASH** (Nerm & Lehn (2010))
- **VPAS** (Laver et al. (1981))
- **GRBAS** (Hirano (1981))
- **RASAT** (Pinho & Pontes (2002))
- **RASATI** (Pinho & Pontes (2008))
- **Buffalo III VP** (Wilson (1987))
I. REVIEW OF THE LITERATURE

**CAPE-V**
ASHA (2006)

Widely used by health and/or educational professionals in voice field (i.e. SLP, ENT, voice teachers).

**GRBAS**
Hirano (1981)

Nemr et al. (2012)
I. REVIEW OF THE LITERATURE

**CAFE-V**

**Phonatory tasks** → [a, i] sustained + sentences reading + spontaneous speech

ASHA (2006)
Kempster et al. (2009)
I. REVIEW OF THE LITERATURE

CAPE-V

Phonatory tasks

[a, i] sustained + sentences reading + spontaneous speech

Vocal parameters

- Overall severity
- Roughness
- Breathiness
- Strain
- Pitch
- Loudness
I. REVIEW OF THE LITERATURE

**CAFE-V**

**Phonatory tasks** → 
[a, i] sustained + sentences reading + spontaneous speech

**Vocal parameters** →
- Overall severity
- Roughness
- Breathiness
- Strain
- Pitch
- Loudness

**Rating scale** → **Visual-analog (0 – 100 mm)**
Several studies have addressed **CAPE-V psychometric characteristics**:

- **Validity** – content, construct and concurrent;
- **Reliability** – inter- and intra-rater.

References:

- Jesus et al. (2009b)
- Jesus et al. (2009a)
- Karnell et al. (2007)
- Kelchener et al. (2010)
- Mozzanica et al. (2013)
- Nerm et al. (2012)
- Nerm et al. (2015)
- Núñez-Batalla et al. (2015)
- Zraick et al. (2011)
Several studies have addressed CAPE-V psychometric characteristics:

Supporting its use for clinical and scientific auditory-perceptual voice evaluation.

- Jesus et al. (2009b)
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I. REVIEW OF THE LITERATURE

• **CAPE-V original version** can not be applied to European Portuguese (EP) because of the differences between these languages.

• **CAPE-V was translated into EP in 2009.**
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- **CAPE-V was translated into EP in 2009.**

  Psychometric analysis revealed some validity and reliability problems.

Jesus et al. (2009b)
Jesus et al. (2009a)
• **CAPE-V original version** cannot be applied to European Portuguese (EP) because of the differences between these languages.

• **CAPE-V** was translated into EP in 2009.

**Psychometric analysis revealed some validity and reliability problems.**

Jesus et al. (2009b)
Jesus et al. (2009a)
I. REVIEW OF THE LITERATURE

Develop a valid and reliable EP version of the 2\textsuperscript{nd} edition of CAPE-V

Based on the \textbf{psychometric characteristics} recommend by SACMOT*

*SACMOT – “Scientific Advisory Committee of the Medical Outcomes Trust”
I. REVIEW OF THE LITERATURE

Develop a valid and reliable EP version of the 2nd edition of CAPE-V

Based on the psychometric characteristics recommend by SACMOT

2nd EP version of CAPE-V (II EP CAPE-V)

*SACMOT – “Scientific Advisory Committee of the Medical Outcomes Trust”*
I. REVIEW OF THE LITERATURE
I. REVIEW OF THE LITERATURE

1. II EP CAPE-V validity:
   1.1. Content validity;
   1.2. Construct validity;
   1.3. Concurrent validity;

2. II EP CAPE-V reliability:
   2.1. Inter-rater reliability;
   2.2. Intra-rater reliability;
III. METHODS
II. METHODS

Research design:

- Transversal
- Observational
- Descriptive
- Comparative
Speakers:

• Nonrandomized convenience sample;

• 20 EP speakers

Control group (CG) (n=10)
5 M (\bar{X} 45 yrs)
5 F (\bar{X} 43 yrs)

Dysphonic group (DG) (n=10)
5 M (\bar{X} 45 yrs)
5 F (\bar{X} 42 yrs)
II. METHODS

Speakers:

- Nonrandomized convenience sample;

- 20 EP speakers

  - Control group (CG) (n=10)
    - 5 M (X 45 yrs)
    - 5 F (X 43 yrs)
  
  - Dysphonic group (DG) (n=10)
    - 5 M (X 45 yrs)
    - 5 F (X 42 yrs)

Matched by age and gender
II. METHODS

Listeners:

• Nonrandomized convenience sample;

• 14 SLT
  ▪ >5 yrs voice clinical practice;
  ▪ Weekly voice cases;
  ▪ Bilateral normal hearing limits for speech production;

  2 M (\(\bar{X}=28\) yrs)
  12 F (\(\bar{X}=38\) yrs)
II. METHODS

Voice samples were recorded on TASCAM DR-05 coupled to PYLE PMEMI.

Ambient noise < 50 dB confirmed by SLM305.

Electret condenser, omnidirectional with linear frequency response 20Hz-20KHz and sensitivity -44dB±3dB.

16 bits, mono, with a sample frequency of 44100 Hz.
II. METHODS

II EP CAPE-V

<table>
<thead>
<tr>
<th>Grau de severidade global</th>
<th>C</th>
<th>1</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rouquidão</td>
<td>C</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Soprealtidade</td>
<td>C</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Tensão</td>
<td>C</td>
<td>1</td>
<td>100</td>
</tr>
</tbody>
</table>

Classifique cada parâmetro vocal numa escala de “0” (normal), “1” (alteração ligeira), “2” (alteração moderada) e “3” (alteração severa).

Escala GRBAS1

- G - Grau
- R - Rouquidão
- S - Soprealtidade
- A - Assenta
- S - Tensão

COMENTÁRIOS SOBRE A RESSONÂNCIA: Normal
ALTERADA [Breve descrição]

FACTORES ADICIONAIS (por ex.: disfonia, aspera, falto, assen, afronta, intensidade, tonos, esonência, "glottal fry", outros aspectos relevantes)

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1 Hirano (1981)
II. METHODS

CAPE-V re-translation, granted by ASHA
II. METHODS

CAPE-V re-translation, granted by ASHA

1. **Reading aloud sentences**
   Proposal of 6 new sentences adapted to EP

2. **Spontaneous speech**
   Prompt “Tell me about the place where you grew up”
II. METHODS

CAPE-V re-translation, granted by ASHA

Sentence A

[nu’dumigui’/stev’so’fujko’ue’vo’tonjwa’ple’nade’evureku’merumee’pade]

“On Sunday it was sunny and I went with grand-father António to the terrace of the “Évora” cafe to eat a pie”

➢ Target:

Coarticulatory influence of all oral and nasal EP vowels.
Sentence B

[si’yũdusi’mẽw’/sɔsə’muŋe’ʃaβi]  

“According to Simão, only Samuel knows”

➢ Target:  
Soft glottal attacks in voiceless to voiced transition.
CAPE-V re-translation, granted by ASHA

Sentence C

[əˈζɛ/ˈmɛjduɡɐbriˈeʃ/ˈdɛwʊurnishedˈrɛζeiˈvɨɲuˈvɐjʊdiˈɾunɐ]

“Zé, Gabriel’s mother, gave him an orange cake and old wine from Runa”

Target:
Eventual voiced stoppages/spasms produced by all EP voiced phonemes.
II. METHODS

CAPE-V re-translation, granted by ASHA

Sentence D

[ˈɛˈcrepənˌɾakeˈiraˈkase]

“It is time for Urraca to go hunting”

➢ Target:

Hard glottal attach through words beginning with vowels.
Where I play, there is a swallow’s nest next to the wall.

Sentence E

[ˈoːdewˈbrikəu/ˈaʊniŋudəduˈrɪnezɛkuʃˈtadwawˈmuru]

“Where I play, there is a swallow’s nest next to the wall”

Target:

Hyponasality and possible stimulability for Resonant Voice Therapy through words with all EP nasal vowels and consonants.
II. METHODS

Target: **Hypernasality** or nasal air emission through voiceless plosive sounds.

**Sentence F**

[e’kikupe’poe’tue’kae’prete]

“Kika covered your black cape”

**CAPE-V re-translation, granted by ASHA**
II. METHODS

CAPE-V re-translation, granted by ASHA

ENT appointment of Speakers
(direct laryngoscopy)

Control group (n=10)
(no organic/functional laryngeal disorder)

Dysphonic group (n=10)
(presence of organic/functional laryngeal disorder)
II. METHODS

CAPE-V re-translation, granted by ASHA

ENT appointment of Speakers (direct laryngoscopy)

Control group (n=10) (no organic/functional laryngeal disorder)

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Voice recording of 20 speakers (CAPE-V phonatory tasks)
II. METHODS

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Voice recording of 20 speakers (CAPE-V phonatory tasks)

14 judges listened to 26 voice samples and rated them with II EP CAPE-V
II. METHODS

CAFE-V re-translation, granted by ASHA

ENT appointment of Speakers (direct laryngoscopy)

Control group (n=10) (no organic/functional laryngeal disorder)

Dysphonic group (n=10) (presence of organic/functional laryngeal disorder)

Voice recording of 20 speakers (CAPE-V phonatory tasks)

14 judges listened to 26 voice samples and rated them with II EP CAPE-V

14 judges listened to 26 voice samples and rated them with GRBAS

1 week interval
II. METHODS

Statistical analysis

• Validity
  ▪ Construct validity (Student t-test, $\alpha=.05$)
  ▪ Concurrent validity (multi-serial correlation, $r>.70$)

• Reliability
  ▪ Inter-rater reliability ($ICC>.70$)
  ▪ Intra-rater reliability (Pearson correlation, $r>.70$)
### Statistical analysis

- **Validity**
  - Construct validity (*Student t-test, α=.05*)
  - Concurrent validity (*multi-serial correlation, r>.70*)

- **Reliability**
  - Inter-rater reliability (*ICC>.70*)
  - Intra-rater reliability (*Pearson correlation, r>.70*)

- **SPSS 22.0** *(IBM SPSS, 2013)*
II. METHODS

Statistical analysis

• Validity
  ▪ Construct validity (*Student t* test, α=.05)
  ▪ Concurrent validity (*multi-serial correlation, r*.70)
    ▪ **LISREL 8.80** (Jöreskog & Sörbom, 2006)

• Reliability
  ▪ Inter-rater reliability (*ICC*.70)
  ▪ Intra-rater reliability (*Pearson correlation, r*.70)
III. RESULTS

IV. RESULTS
## Construct validity of II CAPE-V PE

<table>
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<tr>
<th>Vocal parameter</th>
<th>Control group Mean±SD</th>
<th>Dysphonic group Mean±SD</th>
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<tbody>
<tr>
<td>Overall severity</td>
<td>12.77 ± 11.88</td>
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<td>26.59 ± 11.06</td>
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<td>Pitch</td>
<td>7.98 ± 5.18</td>
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SD=standard deviation; p<.05
### III. RESULTS

**Construct validity of II CAPE-V PE**

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Concurrent validity of II CAPE-V PE

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$r > .70$
### Concurrent validity of II CAPE-V PE

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### Inter-rater reliability of II CAPE-V PE

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ICC=intraclass correlation coefficient
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ICC=intraclass correlation coefficient
Intra-rater reliability of II CAPE-V PE

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<th>Nº of raters with $r &gt; .70$</th>
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<tr>
<td>Overall severity</td>
<td>.87</td>
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<tr>
<td>Roughness</td>
<td>.61</td>
<td>6</td>
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<tr>
<td>Breathiness</td>
<td>.87</td>
<td>8</td>
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<tr>
<td>Strain</td>
<td>.73</td>
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</tbody>
</table>

$r > .70$
V. DISCUSSION
### II EP CAPE-V Content Validity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Validity</th>
</tr>
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<tbody>
<tr>
<td>Overall severity</td>
<td>✓</td>
</tr>
<tr>
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### II EP CAPE-V

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<tr>
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<tr>
<td>Pitch</td>
<td>✓</td>
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<tr>
<td>Loudness</td>
<td>✓</td>
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</table>

- Assured by an EP linguistic expert:
  - 6 new sentences
  - Spontaneous speech
    - “Tell me about the place where you grew up”
<table>
<thead>
<tr>
<th>II EP CAPE-V</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Content</td>
</tr>
<tr>
<td>Overall severity</td>
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<td>Roughness</td>
<td>✓</td>
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<td>✓</td>
</tr>
<tr>
<td>Loudness</td>
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</tbody>
</table>

✓ = p<.05; ✗ = p>.05
### IV. DISCUSSION

<table>
<thead>
<tr>
<th>II EP CAPE-V</th>
<th>Construct validity</th>
<th>p-value</th>
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<tbody>
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<td>Overall severity</td>
<td></td>
<td>.01*</td>
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*p < .05*
## IV. DISCUSSION

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<tr>
<td>Loudness</td>
<td><strong>.04</strong>*</td>
</tr>
</tbody>
</table>

$p < .05$

### Similar to:
- Mozzanica et al. (2013)
- Nerm et al. (2015)
### IV. DISCUSSION

- $\bar{X}_{DG} > CG$;

<table>
<thead>
<tr>
<th>II EP CAPE-V</th>
<th>Construct validity</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall severity</td>
<td></td>
<td>.01*</td>
</tr>
<tr>
<td>Roughness</td>
<td></td>
<td>.00*</td>
</tr>
<tr>
<td>Breathiness</td>
<td></td>
<td>.01*</td>
</tr>
<tr>
<td><strong>Strain</strong></td>
<td></td>
<td>.52</td>
</tr>
<tr>
<td>Pitch</td>
<td></td>
<td>.01*</td>
</tr>
<tr>
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<td></td>
<td>.04*</td>
</tr>
</tbody>
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$p < .05$
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</table>

- $\bar{X}_{DG} > \bar{X}_{CG}$;
- Vocal parameter with $> \bar{X}$ e SD in CG.
## II EP CAPE-V

<table>
<thead>
<tr>
<th>II EP CAPE-V</th>
<th>Content</th>
<th>Construct</th>
<th>Concurrent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall severity</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
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<td>Roughness</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Strain</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Pitch</td>
<td>✓</td>
<td>✓</td>
<td>NA</td>
</tr>
<tr>
<td>Loudness</td>
<td>✓</td>
<td>✓</td>
<td>NA</td>
</tr>
</tbody>
</table>

✓ = >.70; ✗ = <.70; NA = Not applicable
### Concurrent validity: multi-serial correlation

<table>
<thead>
<tr>
<th>II EP CAPE-V GRBAS</th>
<th>Overall severity/grade</th>
<th>Roughness</th>
<th>Breathiness</th>
<th>Strain</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>.95</td>
<td>.89</td>
<td>.90</td>
<td>.47</td>
</tr>
</tbody>
</table>

Similar to:
- Karnell et al. (2007)

$r > .70$
## Concurrent validity

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$r > .70$

> then:
- Jesus et al. (2009b)
- Zraick et al. (2011)
- Mozzanica et al. (2013)
- Núñez-Batalla et al. (2015)
### II EP CAPE-V GRBAS

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\( r > .70 \)

- Karnell et al. (2007)
- Zraick et al. (2011)
- Mozzanica et al. (2013)
- Núñez-Batalla et al. (2015)
<table>
<thead>
<tr>
<th>II EP CAPE-V</th>
<th>Content</th>
<th>Validity</th>
<th>Reliability</th>
<th>Inter-rater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construct</td>
<td>Concurrent</td>
<td></td>
</tr>
<tr>
<td>Overall severity</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>NA</td>
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</tr>
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<td>Loudness</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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✓ = >.70; ✗ = <.70; NA=Not applicable
## IV. DISCUSSION

<table>
<thead>
<tr>
<th>II EP CAPE-V</th>
<th>Inter-rater reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall severity</td>
<td>(0.96)</td>
</tr>
<tr>
<td>Roughness</td>
<td>(0.92)</td>
</tr>
<tr>
<td>Breathiness</td>
<td>(0.95)</td>
</tr>
<tr>
<td>Strain</td>
<td>(0.84)</td>
</tr>
<tr>
<td>Pitch</td>
<td>(0.86)</td>
</tr>
<tr>
<td>Loudness</td>
<td>(0.90)</td>
</tr>
</tbody>
</table>

\(\text{ICC}>0.70\)
## IV. DISCUSSION

### II EP CAPE-V Inter-rater reliability

<table>
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<tr>
<th>Measure</th>
<th>ICC</th>
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<tbody>
<tr>
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<td>.96</td>
</tr>
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ICC > .70

**Similar to:**

- Jesus et al. (2009a)
### II EP CAPE-V

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**ICC > .70**

**> then:**
- Karnell et al. (2007)
- Kelchener et al. (2010)
- Zraick et al. (2011)
- Nerm et al. (2012)
- Mozzanica et al. (2013)
- Núñez-Batalla et al. (2015)
## III EP CAPE-V

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<thead>
<tr>
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<th>Validity</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Construct</td>
</tr>
<tr>
<td>Overall severity</td>
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</tr>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Breathiness</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Strain</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Pitch</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Loudness</td>
<td>✓</td>
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✓ = >.70; × = <.70; NA=Not applicable
### II EP CAPE-V

<table>
<thead>
<tr>
<th>Metric</th>
<th>Intra-rater reliability</th>
</tr>
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<tbody>
<tr>
<td>Overall severity</td>
<td>0.87</td>
</tr>
<tr>
<td>Roughness</td>
<td>0.61</td>
</tr>
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</tr>
<tr>
<td>Strain</td>
<td>0.73</td>
</tr>
<tr>
<td>Pitch</td>
<td>0.92</td>
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<tr>
<td>Loudness</td>
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</table>

$r > 0.70$
### Intra-rater reliability

<table>
<thead>
<tr>
<th>II EP CAPE-V</th>
<th>Intra-rater reliability ( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall severity</td>
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\( r > .70 \)

< then:
- Mozzanica et al. (2013)
- Núñez-Batalla et al. (2015)
### Intra-rater reliability

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<tr>
<td>Loudness</td>
<td>.69</td>
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</tbody>
</table>

$r > .70$

Compared to Zraick et al. (2011):
- $=$ breathiness e e loudness;
- $>$ overall severity; strain and pitch;
- $<$ roughness.
Study limitations:

• Related with:
  ▪ Listeners with > 5 years of clinical experience in voice disorders;
Study limitations:

- Related with:
  - Listeners with > 5 years of clinical experience in voice disorders;
  - Non anchor stimuli before rating sessions.
Future research:

- Study the impact of listeners experience in the II EP CAPE-V psychometric characteristics;
Future research:

• Study the impact of listeners experience in the II EP CAPE-V psychometric characteristics;

• Study the impact of the stimulus type: auditory-visual vs auditory solo in the strain parameters rating;
**Future research:**

- Study the impact of listeners experience in the II EP CAPE-V psychometric characteristics;
- Study the impact of the stimulus type: auditory-visual vs auditory solo in the strain parameters rating;
- Study the sensibility of each II EP CAPE-V phonatory task.
VI. CONCLUSION
• II EP CAPE-V is a valid and reliable instrument for auditory-perceptual voice evaluation of EP language;

• This study established content, construct and concurrent validity, as well as inter- and intra-rater reliability of the II EP CAPE-V.
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Dra. Rita Ferreira

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Mónica C. e Silva
Carlos Ibrahim

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Inês Moura
Joana Assunção
João Fartaria
Leonor Fontes
Luísa P. Nobre
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Mariana Pinheiro
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