CONCEPTUALIZATION OF VIOLIN QUALITY BY EXPERIENCED PERFORMERS

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ABSTRACT

This paper explores how violin quality is conceptualized as reflected in spontaneous verbal descriptions by experienced performers collected while playing in a perceptual evaluation experiment. Players were asked to rank the different violins in order of preference and to justify their ranking in free-format responses. The constant comparison analysis from grounded theory was employed to develop a classification scheme of concepts and the attributes that embody them. A quantitative analysis, based on the number of occurrences for each attribute and concept, provided a hierarchy of violin preference criteria/quality concepts: The conceptualization of violin quality encompasses the response of the violin to the various techniques and musical intentions in direct association with the quantity and quality of the produced sound as well as the emotions and values of the player.

1. INTRODUCTION

The prominent nineteenth century Italian cellist Alfredo Piatti once spoke of his Stradivarius cello (from *The Adventures of a Cello* by C. Prieto):

> I have at times become enamoured at the sight of a *fine* instrument, have been impressed by its *beauty*, and when I have become its owner I have tried to believe that its tone equalled that of my Stradivari. Time, however, has invariably seen me return to my old friend with a feeling of *satisfaction* difficult to explain. True, the differences of tone between my Stradivari and other recognized *fine* instruments are subtle, but I can only say that I obtain from the former a *depth* and *nobility* of tone which ever affords me a sense of *contentment*; in fact, there is something *unattainable* elsewhere.

What is a "fine" violin? A long-standing goal of violin acoustics has been to identify which vibro-acoustical factors affect the timbre and feel of a particular instrument—for example, its perceived "depth," thus distinguishing one violin from another. Most previous research has traditionally attempted to answer this question through mechano-acoustical measurements and/or listening tests. Both approaches seem unsuitable for addressing the critical role of the violin player in determining the quality of an instrument. To this end, recent studies have focused attention to the perceptual and cognitive processes that take place when players assess violins in playing tests [1–6]. Of particular interest is the diverse vocabulary shared by musicians to describe the quality of a violin or its sound, as illustrated in Piatti's own words, and how these verbalizations can be mapped to acoustical properties of the instrument.

As part of the VIOCADEAS project, a standardized qualitative violin evaluation procedure was proposed [7]. Frequently used English descriptions of violin sound were grouped according to different quality categories: across range (*evenness of tone, evenness of response, problem notes on each string*), overall (*loud, responds easily*), tonal qualities (*mellow* vs. *strong*, *gritty* vs. *smooth*, *harsh* vs. *warm*, *thin* vs. *deep*, *complex* vs. *one-dimensional*, *tight* vs. *open*, *fuzzy* vs. *clear*, *bright* vs. *dark*), and playing qualities (*transient behaviour, notes hard to play very softly or very loudly*). Each description was mapped to an acoustical or spectral property—for example, a *complex* sound "has many overtones and color."

In another study, sixty-one common English adjective descriptions of desirable and undesirable violin tone qualities were collected and then arranged by violinists on a two-dimensional map, so that words with similar meanings lay close together, and those with different meanings lay far apart [1]. Multidimensional scaling demonstrated consistent use among performers of many words, and highlighted which words are used in similar situations. It was also observed that almost all verbal descriptions of violin sound incorporate an evaluative judgement as being either good or bad qualities. Further, three dimensions for the characterization of violin sound quality emerged (with acoustical and perceptual interpretations): *warm/rich/mellow* vs. *metallic/cold/harsh* (spectral balance, undesirable qualities associated with excessive high-frequency content or too little low-frequency content); *bright/responsive/lively* vs. *muted/dull/dead* ("amount of sound" produced by the instrument, particularly in the middle and upper ranges); and *even/soft/light* vs. *brash/rough/ raspy* (noisy character, i.e., width of distribution of spectral energy).

It is unclear whether the acoustical interpretations of verbal violin sound descriptions suggested in these studies are

reliable or generalizable, primarily because they are based only on a priori knowledge of the respective authors as opposed to emerging concepts grounded in the verbal data. Attempts to find relationships between measurable vibrational properties of violins and their perceived qualities first require a closer look into the ways violinists process and conceptualize the latter. To this end, a recent study examined the differences between preference judgements made by violin players in active playing vs. passive listening situations in conjunction with psycholinguistic analyses of free-format verbal French descriptions of the participants' experience [2]. Two distinct objects under evaluation for the violinist were identified: descriptions refer either to the sound of the violin (e.g., sound is *acide* or with *une certaine chaleur*) and/or to the instrument itself (e.g., the violin is *facile à jouer* or *très égal*). Results suggested that the influence of sound on the overall evaluation of a violin varies between playing and listening conditions. This seems to support the discussion that, concerning the perspective of the player, listening tests are probably not much indicative of the processes that take place when assessing the qualities of a violin; playing-based evaluations afford a higher level of ecological validity [3].

The present study aimed at identifying the different concepts and situations of violin quality relevant to the player and how they link to each other: what is meant by "depth" of tone and how this relates to the "beauty" of Piatti's cello. An open-ended questionnaire was given to experienced violin players during an experiment for the perceptual evaluation of violins. In the experiment, musicians were asked to play and rank a set of different violins in terms of preference and subsequently justify their choices through answering open-ended questions.

2. METHOD

2.1 Participants

Twenty skilled string players took part in this experiment (8 females, 12 males; average age = 34 yrs, SD = 13 yrs, range = 20–65 yrs; 11 native English speakers, 3 native French speakers, 6 other). They had at least 15 years of violin experience (average years of violin training = 26 yrs, SD = 12 yrs, range = 15–60 yrs; average hours of violin practice per week = 15 hrs, SD = 9 hrs, range = 9–30 hrs), owned violins with estimated prices ranging from less than $1K to $30K, and were paid for their participation. Thirteen participants described themselves as professional musicians, and 8 had higher-level degrees in music performance (MMus, MA, DMus, DMA). They reported playing a wide range of musical styles [classical (95%), folk (47%), baroque (37%), jazz/pop (10%), and contemporary (5%)] and in various types of ensembles [chamber music (70%), symphonic orchestra (70%), solo (55%), and folk/jazz band (40%)].

2.2 Preference ranking task

Participants freely played 8 violins of different make and age and ranked them from least to most preferred in 5 identical trials. Participants returned for a second, identical session 3–7 days later. Violins of different periods were used, varying from student to performance level. Low light conditions and dark sunglasses were used to hide the identity of the instruments as much as possible. Considering the bow as an extension of the player, violinists carried out the task using their own bow (see [3] for a detailed discussion on the control of certain experimental conditions).

2.3 Questionnaire and procedure

Taking into account the lingual diversity of Quebec, we compiled a bilingual questionnaire in English and French and invited participants to respond in that language they felt most comfortable with. To avoid confining the responses into pre-existing categories, we formed very general, open-ended questions with input from an expert in the psycholinguistic evaluation of sound quality. The same questionnaire was used in both experimental sessions. Upon completing the first trial, participants provided spontaneous verbal (written) responses to the questions:

QA1. *How and based on which criteria did you make your ranking? / Avec quels critères avez-vous effectué votre classement et de quelle façon les avez-vous utilisés ?*

QA2. *Considering the violin that you ranked as "most preferred," can you say why? / A propos du violon que vous avez classé comme votre préféré : pourriez-vous nous dire pourquoi ?*

QA3. *Considering the violin that you ranked as "least preferred," can you say why? / A propos du violon que vous avez classé en dernier : pourriez-vous nous dire pourquoi ?*

At the end of each subsequent trial, they were given the opportunity to modify their initial response if they so wanted. Upon completing the last trial, participants responded to the question:

QB. *More generally, what is a very good violin for you? / En général, comment définissez-vous personnellement un très bon violon ?*

2.4 Analysis

All answers across the four questions were consolidated in a single data set as all questions were directly related to violin preference and quality descriptions. In each of the sessions, all participants answered questions QA1–QA3 in up to 4 trials as well as question QB (one time only). In total, 680 phrasings (34 phrasings per respondent on average, SD = 12) were extracted from the data. Of the phrasings, 61% came from professional musicians answers and 39% from amateur violin players answers. In total, 5 participants answered in French and we chose not to translate the phrasing extracted from their answer.

We used the constant comparison technique from grounded theory [8] to extract emergent concepts and attributes from the free-format verbal responses. Contrary to the typical approach of beginning with a hypothesis, grounded theory provides a systematic way of formulating a theory that is

THEME	CONCEPT	*Property*	Classification scheme	#	%
HANDLING	RESPONSE	*Ease*	ease of playing; liberty; flexibility; ease of response; playability	76	11
		Speed & Articulation	responsive; successive notes do not blend together; blurry; muddy; clarity; transients; articulates well; missing of the tuning; playability	47	7
	DESIGN & COMFORT		size; shape; weight; curvature; comfort; feel of the instrument: bulk, lightness	42	6
SOUND	CAPACITY	*Resonance*	resonant; ringing; vibrant; present; open; ample; muffled; éteint; tight; dormant; singing; muted; brillance; brilliant; bright; nasillard; liveliness; sonority	74	11
		Projection	projection; ability of the sound to fill the room; ability of the sound to travel; to carry in a hall; focus; dry	41	6
		Power & Volume	powerful sound; a violin that carries a lot of sound; big; small; mince; weak; strong; thick; thin; petit	39	6
	TIMBRE	*Texture*	rough; raw; grossiere; soft; smooth; sweet; mellow; velvety; silky; golden; warm; cushioned; round; harsh; tinny; shrill; strident; stringy; acide	72	11
		Richness	rich; deep; hollow; has weight; flat; rich in/with a lot of harmonics/overtones; full, range/palette of colors/timbres; dark; complex; simple; colorless	63	9
		Timbre-abstract	tone quality; sound quality; timbre; color; color of sound; sound color	13	2
	CLARITY		pure; clean; direct; straightforward; no wolf tones; buzzing; scratches; whistles; (doesn't) speak well; blurry; muddy	48	7
	SOUND-GENERIC		toujours en écoutant le son du violon; avec le registre les plus bas, et le registre le plus haut; based on the sound	7	1
	BALANCE ACROSS STRINGS		well adjusted and balanced from G-string till E-string; the tone was very even over the range of the instrument; string differentials; consistency across the range of the instrument	55	8
RELEVANCE	AFFECTIVE REACTIONS		interesting; beautiful; fascinating; irritating; overbearing; pleasant; pleasing; fun to play; enjoyable	72	11
	MUSICAL & EMOTIVE POTENTIAL		can respond emotionally and dramatically to my playing; can do anything you want it to; does not require me to work too hard to overcome its personality but lets me play my own; possibility to vary my vibrato and bow pressure for my musical needs	40	6

Table 1. Classification scheme for the conceptualization of violin quality in player verbal descriptions. Number (#) and percentage (%) of occurrences across all four questions for each class are shown in the two rightmost columns.

grounded in data. One component of grounded theory is the constant comparison technique, whereby a theory is generated through contrasting emergent concepts at every level of analysis.

Linguistic devices constructed on the same stem (e.g., "rich," "richness") were grouped together. We also grouped together lexical devices that were semantically related (e.g., "balance" and "evenness"). To better illustrate the relationships between different concepts, we allowed the same phrasing to be coded into more than one categories (i.e., the derived concepts are not mutually exclusive).

3. RESULTS

The inductive analysis principle of grounded theory generates groupings starting from low levels to reach, a posteriori, more abstract themes. But we will instead discuss these themes from the more generic to the more specific for the sake of argumentation. A typographic-style scheme is used to differentiates these different levels of categorization: highest-level themes are displayed in LARGE CAPITAL LETTERS; high-level concepts in SMALL CAPITAL LETTERS; and low-level properties in *Italics*.

At a first level of analysis, three underlying themes of evaluation emerged from the data: the HANDLING of the instrument, the produced SOUND, and the RELEVANCE to the player. A second level of analysis revealed eight concepts of violin quality, each situated within one of the three themes: {DESIGN & COMFORT, RESPONSE}, {TIMBRE, CAPACITY, CLARITY, SOUND-GENERIC}, and {AFFECTIVE REACTIONS, MUSICAL & EMOTIVE POTENTIAL} respectively. A ninth, autonomous concept also emerged: BALANCE ACROSS STRINGS. A third level of analysis led to a structure of properties for RESPONSE, TIMBRE, and CAPACITY: {*Ease, Speed & Articulation*},

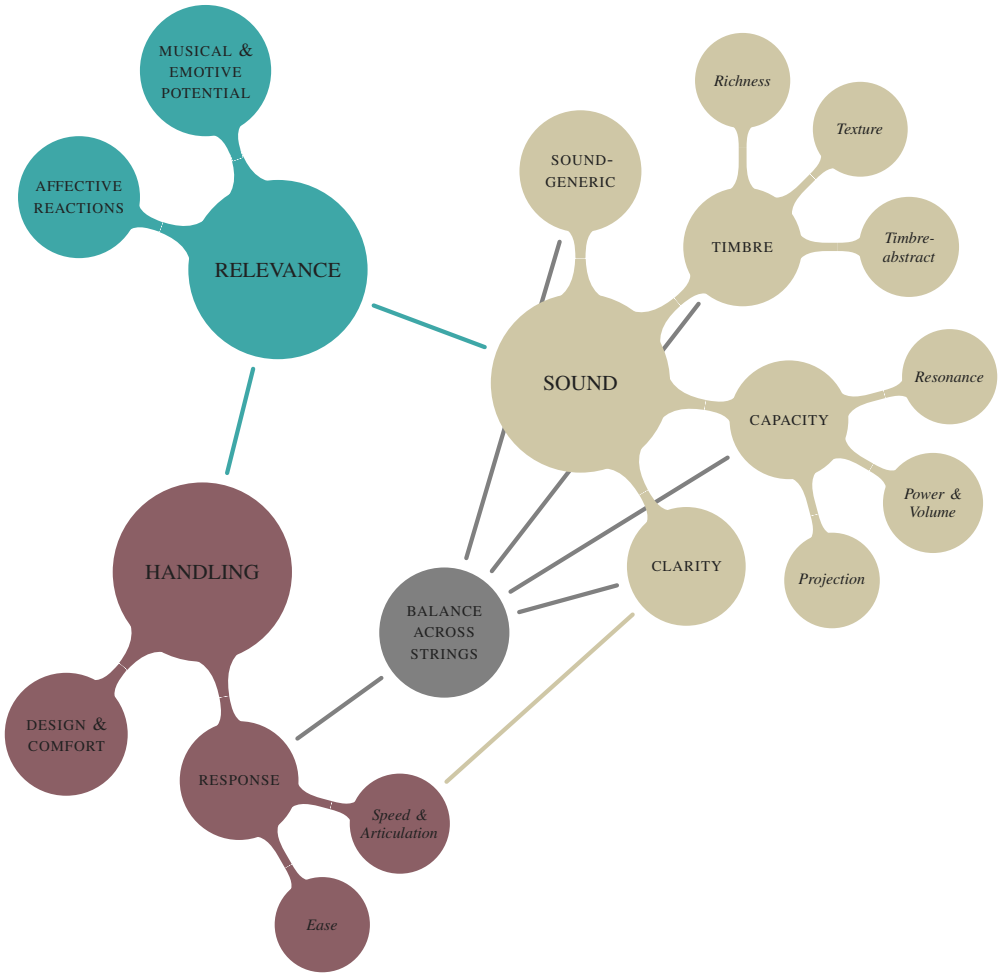

Figure 1. Concept map of emerging CONCEPTS, their *Properties* and underlying THEMES in player verbal descriptions of violin quality evaluation. The size of the circles corresponds to the different levels of categorization; lines indicate how different concepts link to each other (lengths are arbitrary).

{*Richness, Texture, Timbre-abstract*}, and {*Resonance, Power & Volume, Projection*} respectively. The classification scheme is outlined in Table 1. The emerged themes, concepts and properties, and how they link to each other are illustrated in Fig. 1. Definitions are described in the following section.

3.1 Concepts, properties and themes

HANDLING refers to the ergonomic aspects of the violin-musician system and relates to such concepts as responsiveness, comfort and flexibility of playing.

- DESIGN & COMFORT addresses how comfortable it feels to hold the instrument in relation to its size and curvature.
- RESPONSE describes how the instrument behaves when played, how it responds to the actions of the performer. We identified two properties: ease of response to different bowing gestures, and speed of response, which relates to note articulation.
  - *Ease* denotes how easy and flexible it is for the violinist to interact with the instrument and control the played sound.
  - *Speed & Articulation* refers to how quickly and readily the violin responds to the different bowing techniques in terms of transients, dynamics and fast passages.

SOUND comprises descriptions about the quality, quantity and spatiality of the produced sound.

- TIMBRE specifies perceptual attributes of the violin sound related to harmonic content, in particular to spectral density and spread across registers.
  - *Richness* describes a certain quality of full-bodied sound (e.g., "full/fullness") that appears related to harmonic density, particularly in the middle and low frequency regions of violin notes.
  - *Texture* pertains to descriptions of sound semantically associated with touch (e.g., "soft/softness") and taste (e.g., "sweet/sweetness"), and is thus related to the perceived across-range spread of harmonics present in a played note. Similarly to the first dimension of violin quality identified in [1], undesirable qualities such as "strident" or "stringy" appear to be associated with excessive high-frequency content or too little low-frequency content.

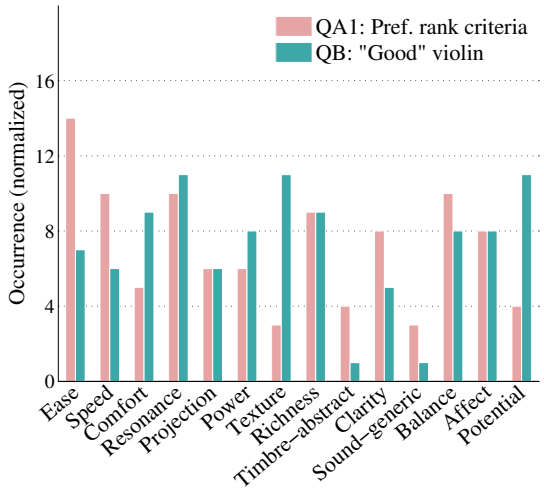

Figure 2. Comparison between preference ranking criteria and characteristics of the "very good" violin (normalized occurrence). Concepts are ordered as in Table 1.

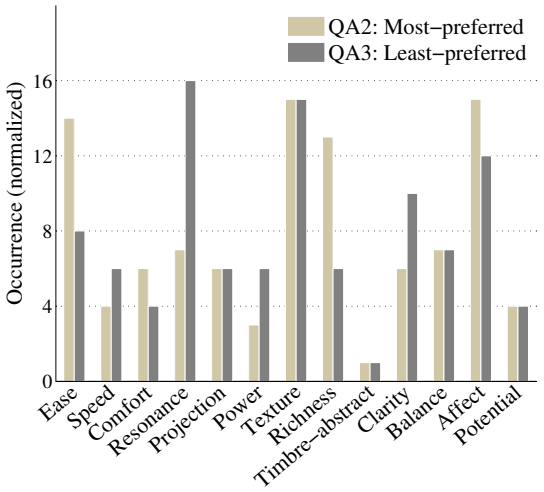

Figure 3. Comparing preference ranking criteria that determined the most- and least-preferred violins (normalized occurrence). Concepts are ordered as in Table 1.

  - *Timbre-abstract* includes abstract allusions to the concept of timbre, such as "color" or "quality" of the sound.

- CAPACITY refers to descriptions of the instrument's ability for substantial sound delivery: a sound that is present (i.e., it *resonates*), has *power* and *projects* well in the performance space.

  - *Resonance* refers to the duration and quality of the sustained part of the sound. It is not related to the physical resonances of the violin body but rather to the perceived presence of a "ringing" sound.
  - *Power & Volume* refers to the perceived intensity of the sound "under the ear." It includes descriptions associated with the semantic field of size/volume (e.g., "big").
  - *Projection* relates to the performance space and concerns the quality and quantity of the played sound at different distances from the musician.

- CLARITY mainly refers to the presence of extraneous noise in the sound, such as wolf tones, "whistles" or "scratches." In this context, "clear" or "clean" is used to describe a sound that is free from audible artifacts. We further identified a second situation, wherein CLARITY is used to describe articulation (i.e., successive notes do not blend together). Hence, the concepts of CLARITY and RESPONSE are linked via the latter's *Speed* property.

- SOUND-GENERIC includes context-free references to the "sound" of the violin (i.e., it was not possible to identify associated concepts).

BALANCE ACROSS STRINGS describes the lack of pronounced differences in the response of the violin across the four strings (e.g., one or several strings being harder to play or slower to respond to varying gestures) as well as the quality of the produced sound across the different registers (e.g., certain notes having too much or too little harmonic content or audible artifacts). It is therefore situated within both HANDLING and SOUND through RESPONSE and {TIMBRE, CAPACITY, CLARITY, SOUND-GENERIC} respectively.

RELEVANCE refers to quality judgements based on the musical, cultural and emotional involvement of the violinist.

- AFFECTIVE REACTIONS includes subjective, emotional and value responses to the sound of the violin as well as the playing experience [9].

- MUSICAL & EMOTIVE POTENTIAL denotes the ability of the violin to convey the musical and affective intentions of the player in varying situations.

3.2 Content analysis and discussion

The distribution of concepts was similar for the two experimental sessions, so we collapsed occurrences across sessions in Table 1. Note that results are reported in terms of number of occurrences of individual phrasings rather than percentages across the respondents as one original response can include several phrasings coded into the same or different concepts. For the conceptualization of the characteristics of the " good" violin, 22% of the phrasings refer to the CAPACITY of the instrument for substantial sound production, 22% to the TIMBRE of the played sound, 18% to the RESPONSE of the violin to the actions of the player, 11% to AFFECTIVE REACTIONS of the violinist to the produced sound and playing experience, 8% to the BALANCE ACROSS STRINGS of response and sound quality, 7% to CLARITY in the played note, 6% to the DESIGN of the instrument and thus the COMFORT of playing, and 6% to the MUSICAL & EMOTIVE POTENTIAL of the violin in performance and personal contexts.

We compared questions QA1, whereby violin preference was described in direct relevance to the experimental setting

(i.e., preference rankings of given instruments), and QB, whereby respondents provided context-free descriptions of violin quality (see Fig. 2). Whereas RESPONSE prevailed when violinists described their preference ranking criteria, it was considerably less present in the general descriptions of the "good" violin. Similarly, violinists called upon *Texture*, POTENTIAL and, to a lesser extent, COMFORT more often in question QB than in QA1. It thus appears plausible that context, or the lack thereof, influences the level of abstraction in the conceptualization of violin quality.

The proportions of concepts within the different discriminating situations of describing the most- vs. the least- preferred violin (from the answers to questions QA2 vs. QA3 respectively) are contrasted in Fig. 3 (SOUND-GENERIC is excluded as we found no related phrasings in the responses to either question). A possible explanation for the differences in the distribution of concepts between the most- and least-preferred violin descriptions is that violin players use different verbalizations to describe instrument qualities they prefer from those they do not.

4. CONCLUSIONS

When evaluating a violin or its sound, musicians call upon a wide diversity of linguistic forms (e.g., nouns, adjectives, expressions, metaphors, etc.) to describe the perceptual qualities of the sound or the instrument. Notably, no previous study has investigated how violinists conceptualize these perceptual qualities. From verbal responses of experienced violinists collected in a preference ranking experiment for the perceptual evaluation of violins, a classification scheme emerged that illustrates the complex links between the different player-typical concepts (e.g., RESPONSE, CLARITY, BALANCE), properties (e.g., *Ease, Richness, Projection*), and underlying themes (HANDLING, SOUND and their RELEVANCE to the individual).

The analysis of the verbal data identified two distinct objects under evaluation for the violin player: the sound of the violin and the instrument itself. This confirms previous findings in violin quality evaluation [2]. To describe the timbre of a particular violin, violinists appear to focus on spectral density (conceptualized in the perceptual attribute of *richness*) and spread (conceptualized in the perceptual attribute of *texture*) across the low, middle and high registers. However, a "good" sound is dependent on the amount of effort required to obtain it, with different musical or subjective situations leading to different degrees of compromise between sound quality and playability. This is illustrated in the following response by one of the participants: "A good violin for me is one that combines an even, resonant, singing tone with good sound production. I often play fiddle and rock music, and although a good sound is always important, I also need to be able to play loudly."

"Rich" (or "richness") was the most frequently quoted description of sound in the data, indicating a strong, widely-shared concept of violin quality. This observation is in agreement with results from a previous, more rudimentary analysis of the verbal responses to answer QA1 [3]. In fact, an analogy may be drawn between the importance of richness in violin sound quality and that of brightness in brass instrument sound quality. We are currently analyzing a different set of violin player verbalizations using a linguistic approach to tease apart the different semantic interpretations of richness [10].

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