Revista Iberoamericana de Psicología y Salud (2024) 15(2) 96-104

Revista Iberoamericana de Psicología y Salud

Iberoamerican Journal of Psychology and Health

https://www.rips.cop.es/ • ISSN: 2171-2069

Revista Oficial de la Federación Iberoamericana de Asociaciones de Psicología (FIAP) - Official Journal of the Latin-American Federation of Psychological Associations

Article

Examining the Persistence of Central and Peripheral Information in Honest Witness

Álvaro Montes[1], Jéssica Sanmarco[1], Blanca Cea[1], Verónica Marcos[1] & Dolores Seijo[1,2]

[1]Unity of Forensic Psychology, Faculty of Psychology, University of Santiago de Compostela, Spain
[2]Departament of Political Science and Sociology, University of Santiago de Compostela, Spain

ARTICLE INFO

Received: 18/04/2024
Accepted: 08/06/2024

Keywords:
Testimony evaluation
Testimony persistence
Testimony validity
True tellers
Complainant testimony

ABSTRACT

Background/Aim: Case Law criterion of persistence of information is strictly and systematically applied in assessing credibility of testimony. Nevertheless, forensic psychological assessment of the credibility of testimony has proposed that this persistence should be interpreted in terms of the 'central/peripheral hypothesis' in the persistence of information, i.e., persistence to assess a testimony as credible is required for the central elements of the event (central information), but not for the peripheral information. An experimental study was designed in order to test this hypothesis. **Method:** A total of 102 adult witnesses (60.8% female) aged 20-75 years (M = 34.55, SD = 14.35) were interviewed (shortened cognitive interview) two times (sequence of statements) about a relevant directly (lived event) self-experienced event (autobiographical memory). The interviews were submitted to a content analysis with a methodical categorical system on the persistence in central and peripheral information. **Results:** The results showed that the memory of honest witnesses was mostly (±85%) made up of peripheral information; that the central information is fully consistent inter-statements; the prevalence of errors of commission (contradictions) and omission (appearance and disappearance of information) in peripheral information in honest memories is more than common ($.50 < p_o < .95$) and normal ($p_o \geq .95$), respectively. **Conclusions:** The hypothesis that honest testimonies are consistent inter-statements (persistence) in central information, but not so in peripheral information, was confirmed. Implications for judicial and forensic evaluation of testimony are discussed.

Examen de la Persistencia en Información Central y Periférica en Testigos Honestos

Palabras clave:
Evaluación del Testimonio
Persistencia en el testimonio
Validez del testimonio
Testimonio honesto
Testimonios verdaderos
Testimonio del denunciante

RESUMEN

Antecedentes/objetivo: El criterio jurisprudencial de persistencia en la información se aplica estricta y sistemáticamente en la evaluación de la credibilidad de un testimonio. Sin embargo, desde la evaluación psicológica forense de la credibilidad del testimonio se ha propuesto que esta persistencia ha de ser interpretada en función de la 'hipótesis central/periférica' en la persistencia de la información, tal que la persistencia de un testimonio honesto es requerida en los elementos centrales del evento, pero no así en la información periférica. Nos planteamos un estudio experimental con el objetivo de someter a prueba esta hipótesis. **Método**: Un total de 102 testigos adultos (60.8% mujeres) de entre 20 y 75 años (M = 34.55; SD = 14.35) fueron entrevistados (entrevista cognitiva recortada) en dos ocasiones (secuencia de las declaraciones) sobre un evento relevante auto-experimentado (memoria autobiográfica) directamente (evento vivido). Las entrevistas fueron sometidas a un análisis de contenido con un sistema categorial metódico en la persistencia de la información central y periférica. **Resultados**: Los resultados mostraron que la memoria de los testigos honestos está conformada mayoritariamente (±85%) por información periférica; que la información central es totalmente consistente inter-declaraciones; la prevalencia de errores de comisión (contradicciones) y omisión (aparición y desaparición de información) en información periférica en memorias honestas es más que común ($.50 < p_o < .95$) y normal ($p_o \geq .95$), respectivamente. **Conclusiones**: Se confirma ha hipótesis de que los testimonios honestos son consistentes en el tiempo (persistencia) en la información central, pero no así en la periférica. Se discuten las implicaciones para la evaluación judicial y forense del testimonio.

Cite as: Montes, Á., Sanmarco, J., Cea, B., Marcos, V., & Seijo, D. (2024). Examining the persistence of central and peripheral information in honest witness. *Revista Iberoamericana de Psicología y Salud, 15*(2), 96-104. https://doi.org/10.23923/j.rips.2024.02.079

Correspondence: Dolores Seijo. Facultad de Psicología. Campus Vida, s/n. 15782 Santiago de Compostela (Spain). E-mail: mariadolores.seijo@usc.es

Introduction

Psychological expert assessment of testimony is the peripheral evidence with the greatest weight (enough to give the testimony evidentiary value and undermine the principle of presumption of innocence) in the judicial estimation of the credibility of testimony, mainly when crimes occur in the private sphere (Arce, 2017; Novo & Seijo, 2010). Although the complainant's testimony may have evidentiary value by itself, testimony credibility, according to Case Law, must be judicially estimated based on 3 criteria: absence of subjective disbelief (lack of subjective credibility), verisimilitude (objective credibility) and persistence in incrimination (Sentencia del Tribunal Supremo 1229/2017, Sala de lo Penal, de 29 de Marzo de 2017). Subjective lack of credibility results from physical or psychological characteristics of the witness (e.g., handicap, young age) or the concurrence of spurious motives (e.g., resentment, revenge, obtaining some benefit). The subjective disbelief criterion of complainant is frequently breached. Nevertheless, even if this criterion is breached, the complaint (statement) is not necessarily invalid or insufficient evidence, as it can be compensated by the principles of verisimilitude (existence of peripheral corroborations that validate the testimony, the most important being the psychological-forensic report on the testimony veracity) and the persistence in incrimination (the account must be coherent, unchanged over time and concrete). The undermining/strengthening of the latter criterion is very often the aim of cross-examination of witnesses (Arce, 2017). Hence, the judicial criterion of persistence equates consistency between statements with greater accuracy and credibility of the account (Arce, 2017). Notwithstanding, the literature has found that inconsistencies over time of honest witness accounts are common, resulting from contamination of the initial account with post-information (Odinot et al., 2013) and may be of internal (self-generated) or external (implanted) origin, such as in the judicial context of cross-examination (Davis & Loftus, 2007).

The interviewer may contaminate the evidence so that it is judicially invalid. The source of contamination is the interrogation because the questions exert informative (e.g., suggestive, reversal, misleading interviewing techniques) and normative (e.g., coercive, friendly, oppressive, aggressive interviewing techniques) pressure, contaminating the memory of the witness, and, in addition, are not productive in terms of criteria of memories of self-experienced events (Arce, 2017). For forensic assessment of the veracity of the testimony, narrative interviews are valid (the memory of the witness is not tainted) and productive (the memories of lived events present more criteria of memory of self-experienced events) (Colwell et al., 2002; Memon et al., 2010; Leal et al., 2023a).

Analysing the accused accounts was the seminal procedure in which psychological assessment techniques approached the study of the veracity of testimony, although this proved ineffective and judicially invalid (Arce, 2017; Porter & Ten Brinke, 2010; Vrij et al., 2010), so techniques currently focus on the complainant testimony. Specifically, the most accepted position at present, both scientifically and judicially, is the one based on cognitive evidence and content analysis of the statement (Novo & Seijo, 2010; Steller & Böhm, 2006), according to which the message of the statement itself provides evidence to assess its veracity. Within this framework, the most widespread theory is the *Undeustch hypothesis* (Undeutsch, 1967), which postulates that memories of lived events differ in content and quality from a memory of the non-experienced (invented or imagined) being scientifically validated (Amado et al., 2015, 2016; Oberlader, 2016). Based on this hypothesis, categorical systems of content analysis of the statements have been developed, most notably the *Criteria Based Content Analysis* (CBCA; Steller & Köhnken, 1990), a categorical system within the *Statement Validity Analysis* (SVA; Steller, 1989) testimony evaluation protocol. However, this protocol has limitations (Arce, 2017) such as: a) the statement is obtained through a semi-structured interview (*Step-wise interview*, Yuille et al., 1993), which contaminates the obtained protocols (Arce, 2017; Walsh & Milne, 2008); b) it consists of a single elicitation of testimony, which prevents assessing temporal consistency (inter-statements), and, hence, prevents verifying the persistence in incrimination criterion (comparison with other statements of the investigation process is indicated, but these are not comparable to the forensic ones as they are contaminated by interrogations), as well as the effects of contamination of post-event information; and c) the forensic judgement is subjective, i.e. it lacks a strict and objective decision criterion (criterial validity).

To overcome these difficulties, Arce & Fariña (2005, 2014) developed and validated a methodical categorical system (Bardin, 1996) to assess the veracity of the testimony, included in a comprehensive assessment protocol, the *Global Evaluation System* (GES). Construction of this categorical system was based on the analysis of categories (productivity, comprehensiveness, relevance) of existing systems (i.e., *Statament Reality Analysis*; Undeutsch, 1989; *Reality Monitoring*, Johnson & Raye, 1981; *Criteria Based Content Analysis*; Steller & Könhken, 1990); on a redefinition of categories (i.e., mutual exclusion, objectivity); and on the concretization of new categories (productivity, comprehensiveness, relevance) by means of a procedure of successive approximations. The resulting categorical system of content analysis of witness memory was reliable ($\alpha = .898$) and valid (discriminant, construct, criterion and predictive; Amado et al., 2015, 2016; Arce et al., 2013; Vilariño et al., 2011), i.e., it is methodical categorial system. The GES allows for the study of both the reality of the testimony and the psychological imprint (see for intimate partner violence victimization, Arce et al., 2009) and the testify capacity, being scientifically endorsed for different types of victimization and population, fulfilling the Daubert criteria to determine whether (or not) experts testimony is based on scientific evidence (Daubert vs. Merrel Dow Pharmaceuticals, 1993), as well as the judicial and case law criteria. The GES splits the testimony evaluation in the validity of the testimony and the content analysis by means of the categorical system (Arce & Fariña, 2005, 2013, 2014). Among the objectives of the validity analysis is the assessment of the persistence of the testimony criterion, which establishes that this should not be understood on the basis of the judicial criterion that equates persistence with greater accuracy and credibility (Arce, 2017), but in terms of the 'central/peripheral hypothesis' in the persistence of information (Arce & Fariña, 2005, 2013, 2014), according to which lack of persistence (contradiction or omission) is only relevant when it affects the central elements of the event, but not the peripheral ones. The memory of an honest witness is reconstructive so that non-core information is not retrieved accurately, being filled in with information accessible to memory. In contrast, fabricated memory is learned and therefore more consistent than honest memory. This analysis is possible because, unlike the SVA, the GES includes a double obtention of the statement (obtained at least with one week

interval), complying with the procedural guarantees for establishing the persistence of the testimony.

Already in his original formulation, Undeutsch (1967) had highlighted the need to contrast two statements (the forensic and the police/court) and to examine their validity based on the lack of persistence and the existence of contradictions between them. Likewise, this makes it possible to obtain, from a scientific point of view, the measure of temporal or intra-testimony consistency (Wicker, 1975) of the statement itself. In this sense, the 'central/peripheral hypothesis' in information persistence is complemented by the Trankell's Hypothesis (Trankell, 1972) according to which the memory of a fabricated event (lie) is more consistent than the memory of an actually experienced, since it is planned and learned. Thus, one would expect an honest interviewed to describe events similarly in different statements, but with different constructions and omissions and inconsistencies in peripheral information, as his/her account is based on sensory memories and not on learned episodic schemas (Arce & Fariña, 2005, 2013, 2014).

Hence, according to the GES technique, if the statements are inconsistent in central aspects or lack stability in time and context, it will be concluded that the testimony is invalid, and the veracity analysis of the testimony will not proceed (and therefore the verisimilitude criterion cannot be sustained). In contrast, inconsistencies will have no effect if are referred to peripheral information, being compatible with truthful statements. This is supported by results that establish that between 80-90% of fabricated memories are insufficient or invalid evidence according to the GES criteria (Arce, 2017). Furthermore, although the judicial criterion of persistence of information does not differentiate between central and peripheral details, this differentiation is present to some extent in judicial decisions. According to a sentences analysis (Arce et al., 2010), forensic evidence where a lack of persistence or contradictions in central elements of the complainant's statements is detected serves to motivate the acquittal of the accused (80% of the time it leads to acquittal); while when the central aspects are consistent (88.9% of the cases end in a guilty verdict), even if there are contradictions in peripheral elements of the complainant's statement, it is common to proceed with the conviction of the accused (it is related to 76.9% of guilty verdicts).

Based on the above, it can be concluded that the literature supports the study of persistence of information between statements to assess the veracity of testimony, but that this should not be interpreted according to the legal criterion of total consistency, but should be interpreted according to the 'central/peripheral hypothesis' in the persistence of information, as established in techniques for assessing the veracity of testimony, and detected, in part, in judicial decisions. Nevertheless, there is no evidence of empirical research aimed at testing the 'central/peripheral hypothesis' in the persistence of information (or the persistence of central and peripheral information between statements), nor at quantifying the amount and characteristics of peripheral details where contradictions or omissions occur in testimony based on memories of lived events. Hence, the need arises to empirically test this central hypothesis for forensic evidence about the veracity of the testimonies and for judicial and court decision-making. Thus, an empirical investigation was designed to test the 'central-peripheral hypothesis' on the persistence of central and peripheral details in memories of lived events.

Method

Participants

A total of 102 adults, 62 women (60.8%) and 40 men (39.2%), aged between 20 and 75 years (M = 34.55, SD = 14.35), randomly selected from the general population participated in the study. The exclusion criterion applied was that they did not have any physical-psychological characteristics that would impair their testimony.

Design and Procedure

An experimental repeated measures study was designed, in which participants were conducted two interviews separated by at least one week, aimed at obtaining (and obtaining replay) a narrative account of a relevant self-experienced event. Since obtaining testimony in a forensic context must be guided by the achievement of all possible information about the event, producing minimal contamination and safeguarding procedural guarantees (Colwell et al., 2002), the Cognitive Interview (CI) (Fisher et al., 1989; Fisher & Geiselman, 1992) was used in order to obtain the protocols. The literature has systematically found that CI provides richer memory (more information) with a better accuracy/error balance than structured interviews (Memon et al., 2010). The CI consists within compendium of four techniques for recovering sensory memories (tell what you could see, smell, hear, feel) in narrative format: a) mental reinstatement of context (asking the interviewer to mentally reinstate the moment of the event to be remembered); b) report everything (asking the interviewee to recount everything they remember, even what may seem unimportant); c) change perspective (asking the interviewee to recount the event from perspectives other than their own); and d) recall in reverse order (asking the interviewee to recall the event from the end to the beginning). With respect to the research (obtaining the statement with the minimal information implanted by the interview), the shortened cognitive interview version consisting by the first two techniques (mental reinstatement of context and report everything) was applied, as it achieves similar productivity results to the original (Davis et al., 2005), controlling for the contamination effect of the testimony (memory) by the interviewer (Arce, 2017).

Participants were contacted through social media advertisements and snowball sampling dissemination. The advertisement informed them about the purpose of the study, participation conditions, information treatment, directing them to an online questionnaire where voluntariness and consent to participate in the study were collected, along with sociodemographic data and a medium of contact (phone or email). Consent, including the recording of interviews, and voluntariness were obtained again in the first evaluation session. Treatment and storage were conducted in accordance with the Spanish Data Protection Act (Ley Orgánica 3/2018, de 5 de diciembre, de Protección de Datos Personales y Garantía de los Derechos Digitales, 2018).

Obtaining Protocols: Interview and Interviewers

The interviews were conducted by two professionals trained in shortened cognitive interview technique, experienced in forensic psychological evaluation, who have also shown to be productive, effective, and consistent with other interviewers in obtaining testimony in forensic cases, thus providing cross-validation and judicial validity

to the interviews. The interviews were made for each participant by the same interviewer. The interviews were recorded for later analysis. Both interviewers obtained equally productive protocols, $t(100) = 0.93$, $p = .354$, in content ($M = 80.33$ vs. $M = 75.24$ details recorded in the interviews for interviewer 1 and interviewer 2). Protocols that did not constitute a rich memory, defined as those with abnormally low production ($\leq .05$) of details ($M - (1.645 * SD)$) were excluded.

Content Analysis of Protocols

A coding system for central and peripheral details was created to detect lack of persistence, in the omission or commission errors (contradictions), between both accounts. First, coders drafted the central information of each account. Central or core information was defined as the schema or script of the story. All information not part of the script was coded as peripheral. Since the memory evoked in the interviews was sensory, a coding system for memory attributes collected in the different versions of Reality Monitoring (Gancedo et al., 2021) was created: temporal, semantic, contextual, idiosyncratic, and perceptual information. Given that the narrative was a story, an additional principal attribute was included from the Story Model (Pennington & Hastie, 1992): causal relationships. Finally, an additional category "others" was created where coders noted any other information that did not fit into any of the previous categories (method of successive approximations).

The resulting system with categories and definitions for coding peripheral details can be seen in Table 1. The unit of analysis for peripheral details was specific content, i.e., cognitions, actions, or grammatical structures with independent meaning.

The content analysis of the interviews using the categorical system was made separately and independently by two coders with experience in forensic and scientific practice (Sanmarco et al., 2023) in categorical coding systems (between-contexts agreement). One coder analyzed 51.96% of the protocols ($n = 53$), while the other examined 48.04% ($n = 49$). In addition, each coder analyzed approximately 20% ($n = 10$) of the protocols conducted by the other coder (between-coders agreement evaluation), and each recoded approximately 20% ($n = 10$) of their own protocols after at least two weeks (intra-coder agreement evaluation).

The statements were transcribed and coded using the aforementioned categorical system. First, the coder drafted the script of the event. Once all protocols were coded, both researchers proceeded to establish the persistence of details between the two interviews conducted with each participant. This involved determining, for each coded detail, its presence in both interviews (hit); its presence in one interview but absence in the other (omission error); or the presence of the same detail in both interviews but in a contradictory manner (commission error).

Coding Fidelity

The fidelity in the protocols coding was analyzed, specifically whether the coders had faithfully applied the categorical system. Thus, the True Agreement Index ($\overline{TAI}$ = agreements/(agreements + disagreements; Arce et al., 2000) was computed, which verifies the exact correspondence in coding both between- and within-coder. This established the fidelity in coding both between-coder and within-coder, ensuring that the categorical records of the coders accurately reflected the system categories, as seen in Table 2. The agreement in coding central details was almost perfect ($\overline{TAI} = .87$ between-coders and .98 and 1 within-coder), while for peripheral information, it was nearly perfect ($\overline{TAI} \geq .80$; Tversky, 1977).

Table 1

Categories and Definitions of the Coding System

Categories and Definitions
Temporal Information • Terms, sequence, and temporal order (before, after, etc.) of the event. • References to time (e.g., year, month, day, hour) and specific dates in the event. • Ages of the participants. • Duration of the event. • Others.
Contextual Information • Specific places and locations (e.g., country, city, place, part of a building). • Arrangement of people, objects or animals. • Characteristic details of the places (utensils, nature, etc.). • Others.
Semantic Information • Sizes. • Colors. • Shapes. • Weight. • Others.
Causal Relationships • Cause-effect relationships. • Sequence of the event/behaviors. • Others.
Idiosyncratic Information • Emotions (joy, sadness, disgust, fear, surprise, and anger). • Feelings (e.g., nervousness, anxiety, pain, fatigue). • Thoughts and reasoning. • Accounts of others' mental states. • Inferences about consequences, probabilities, etc. • Others.
Perceptual Information • Account of visual information. • Account of auditory information. • Account of olfactory information. • Account of tactile information. • Account of gustatory information.
Others • Any other information that can be recorded and evaluated for its stability and is not covered in the previous categories.

Note. Coders did not record details that did not fit any of the categories in the coding system, so it was not necessary to add new categories or definitions (exhaustiveness of the categorical system).

Table 2

Between- and Within-True Agreement Index

Category	Between-coder [95% CI]	Within-c1 [95% CI]	Within-c2 [95% CI]
Central Information	.87[.81, .93]	.98[.94, 1]	1
Peripheral Information	.81[.78, .84]	.97[.95, .99]	.98[.97, 1]
Temporal	.85[.78, .92]	.98[.94, 1]	.98[.95, 1]
Contextual	.81[.75, .87]	.95[.90, 1]	1
Semantic	.79[.61, .97]	1	1
Causal	.76[.67, .85]	.97[.91, 1]	.96[.89, 1]
Idiosyncratic	.80[.73, .87]	.97[.93, 1]	.96[.92, 1]
Perceptual	.78[.59, .97]	.86[.60, 1]	1

Note. Between-coder = between-coder agreement; Within-c1 = within-coder 1 agreement; Within-c2 = within coder 2 agreement; 95% CI = 95% confidence interval.

Tabla 3
Correlation Between- and Within-Coder in the Quantity of Details

Dimension	$n_{between}$	$r_{between}$	n_{within}	$r_{within1}$	$r_{within2}$	r_{rtota}
Total Details	20	.942**	10	.984**	.999**	.987
Central Information	20	.945**	10	.930**	1.000**	.924
Peripheral Information	20	.938**	10	.978**	.999**	.986
Temporal	20	.938**	10	.994**	.996**	.988
Contextual	20	.919**	10	.976**	1.000**	.982
Semantic	20	.938**	10	1.000**	1.000**	.989
Causal	20	.886**	10	.985**	.987**	.976
Idiosyncratic	20	.936**	10	.989**	.998**	.974
Perceptual	20	.946**	10	.928**	1.000**	.979

Note. $r_{between}$ = between-coder correlation; $r_{iwithin1}$ = within-coder 1 correlation; $r_{within2}$ = within-coder 2 correlation; r_{total} = total correlation; *$p < .05$; **$p < .001$.

Reliability of Coding

The reliability of the measure was calculated through correlations between details registered by both coders (between-coders) and within the two codings performed by the same coder (within-coder). The results (see Table 3) eshibit that the measure (content analysis) is highly reliable, both between-coders and within-coder, and overall (Nunnally, 1978).

Data Analysis

Mean differences in information (details) between interviews (interview 1 vs. interview 2) were calculated with paired samples *t*-tests with effect size *d* computed using Lipsey and Wilson's (2001) formula for repeated measures, and effect quantification in information using a derivation of BESD (Corrás et al., 2017). Frequencies of details observed in the interviews were analyzed, transformed into observed proportions (p_o) and contrasted with a constant (zeta). Constants (Arce's criterion values; Vilariño et al., 2018) used were: $p_o = 0$, category registration is highly improbable (*never*); $p_o \leq .05$, registration is trivial (*insignificant*, *almost never*); $.05 < p_o < .50$, registration is significant (*sometimes*); $p_o = .50$, registration is common (*often*); $50 < p_o < .95$, registration is very likely (*almost always);* and $p_o \geq .95$, registration is extremely likely (*always*). The effect size was estimated in Odds Ratio (*OR*).

Results

Analysis of Content Productivity

The total number of coded details was 7934 ($M = 38.89$, $SD = 14.87$), with 4129 in the first interview and 3805 in the second. Comparison of information provided (details) between interviews (order effect: first vs. second) revealed that memories of honest witnesses significantly include more information in the first interview, $t(101) = 4.80$, $p < .001$, ($M = 40.48$ and $M = 37.70$ for the first and second interview, respectively), albeit with a small effect size, $d = 0.21$. On average, the first interview contains 10.4% more information ($r = .104$) than the second.

With regard to gathered details (information), 85.25% ($n = 6764$) were peripheral information and 14.75% ($n = 1170$) were central information; thus, honest witness memory contents are predominantly composed of peripheral information, $\chi^2(1) = 3944.1$, $p < .001$, with peripheral details (information) being 22.2 times more likely to be reported than central details, $OR = 22.2$, 95% CI [21.7, 22.7]. The distribution of peripheral information by categories was uneven, $\chi^2(5) = 2771.2$, $p < .001$, showing post-hoc contrasts (bonferroni correction: $p < .01$) a higher prevalence of contextual information ($n = 2182$, 32.26% of total), $\chi^2(1) = 56.99$), contrasted with temporal ($n = 1711$, 25.30%); idiosyncratic ($n = 1491$, 22.04%), $\chi^2(1) = 130.00$; causal ($n = 828$, 12.24%), $\chi^2(1) = 609.08$); perceptual ($n = 282$, 4.17%), $\chi^2(1) = 1465.10$); and semantic information ($n = 270$, 3.99%), $\chi^2(1) = 1490.92$. Additionally, memories of honest witnesses contain significantly ($p < .0125$) more temporal information (details) than idiosyncratic, $\chi^2(1) = 15.12$; causal, $\chi^2(1) = 307.09$; perceptual, $\chi^2(1) = 1024.61$; and semantic, $\chi^2(1) = 1048.20$, information. Post-hoc contrasts also revealed that memories of honest witnesses contained significantly ($p < .0125$) more idiosyncratic information (details) than causal, $\chi^2(1) = 189.55$; perceptual, $\chi^2(1) = 824.41$; and semantic, $\chi^2(1) = 846.59$ information.

Commission Errors

Regarding commission errors (contradictions) in details, the frequency and probability analysis (see Table 4) showed that the probability of commission errors in central information of honest memories was 0. That is, honest memories of lived events obtained without any contamination are completely consistent in central information.

On the other hand, honest autobiographical memories (see Table 4) are more than common ($.50 < p_o < .95$) to comprise commission errors ($p_o = .618$) in peripheral information, being 30.74 times more likely, a very large effect size, to observe commission errors than expected by chance (.05), $OR = 30.74$. In the subcategories of peripheral information, the results (see Table 4) exhibited a significant probability ($p > .05$) of prevalence of commission errors in temporal information ($p_o = .314$), contextual information ($p_o = .265$) and idiosyncratic information (.118), with the likelihood of errors in temporal, contextual, and idiosyncratic information being 8.70, 6.85, and 2.54 times more likely ($OR = 8.70$, 5.85 and 2.54) than expected by chance.

Table 4
Probability of Commission Errors

Dimension	p_o[95% CI]	$Z(p = .05)$	$OR_{.05}$	$Z(p = .5)$	$OR_{.50}$	$Z(p = .95)$	$OR_{.95}$
Central Information	0	-2.32*	----	10.10***	----	-44.02***	----
Peripheral Information	.618[.524, .712]	26.32***	30.74	2.38*	1.62	-15.38***	0.09
Temporal	.314[.224, .404]	12.23***	8.70	-3.76***	0.45	-29.47***	0.02
Contextual	.265[.179, .351]	9.96***	6.85	-4.75***	0.36	-31.74***	0.02
Semantic	0	-2.32*	----	-10.10***	----	-44.02***	----
Causal	.049[.007, .091]	-0.05	0.98	-9.11***	0.05	-41.75***	0.00
Idiosyncratic	.118[.055, .181]	3.15**	2.54*	-7.72***	0.13	-38.55***	0.01
Perceptual	.039[.001, .076]	-0.51	0.77	-9.31***	0.04	-42.22***	0.00

Note. p_o[95% CI] = observed probability[95% Confidence Interval]; $Z(p = .05)$ = Zeta score(constant = .05); $OR_{.05}$ = Odds Ratio for .05; $Z(p = .5)$ = Zeta score(constant = .50); $OR_{.50}$ = Odds Ratio for .50; $Z(p = .95)$ = Zeta score(constant = .95); *OR*.95 == Odds Ratio for .95; *$p < .05$; **$p < .01$; ***$p < .001$.

Table 5
Probability of Omission Errors

Dimension	p_o[95% CI]	$Z(p = .05)$	$OR_{.05}$	$Z(p = .5)$	$OR_{.50}$	$Z(p = .95)$	$OR_{.95}$
Central Information	0	-2.32*	----	-10.10***	----	-44.02***	----
Peripheral Information	1	44.02***	----	10.10***	----	2.32*	----
Temporal	.971[.938, 1]	42.68***	636.17	9.51***	34.83	0.97	1.76
Contextual	.971[.938, 1]	42.68***	636.17	9.51***	34.83	0.97	1.76
Semantic	.520[.423, .617]	21.78***	20.58	0.40	1.08	-19.93***	0.06
Causal	.892[.832, .952]	39.02***	156.93	7.92***	8.26	-2.69**	0.43
Idiosyncratic	.971[.938, 1]	42.68***	636.17	9.51***	34.83	0.97	1.76
Perceptual	.578[.482, .674]	24.47***	26.02	1.58	1.37	-17.24***	0.07

Note. $N = 102$; p_o[95% CI] = observed probability[95% Confidence Interval]; $Z(p = .05)$ = Zeta score(constant = .05); $OR_{.05}$ = Odds Ratio for .05; $Z(p = .5)$ = Zeta score(constant = .50); $OR_{.50}$ = Odds Ratio for .50; $Z(p = .95)$ = Zeta score(constant = .95); $OR_{.95}$ == Odds Ratio for .95; *$p < .05$; **$p < .01$; ***$p < .001$.

Omission Errors

The results of omissions (lack of consistency in information reported inter-statements) revealed (see Table 5) that omission errors never occur in central details ($p_o = 0$), whereas omission errors were observed in all memories for peripheral information ($p_o = 1$). For subcategories of peripheral information, omission errors in temporal, contextual, and idiosyncratic information are normal ($p_o = .95$) in honest memories of self-experienced events; errors in causal relationships range between common and normal ($.50 < p_o < .95$) and omissions in semantic and perceptual information are common ($p_o = .50$).

Discussion

An experimental study was designed to test the 'central/peripheral hypothesis' on the persistence of information in memories of honest witnesses. First, the results supported that the memory of honest witnesses is mostly (± 85%) made up of peripheral information. Second, the central information is fully (not subject to errors of commission or omission) consistent inter-statements (persistence in judicial language). Thus, the prediction of the 'central/peripheral hypothesis' on central information persistence is confirmed: central information in the memory of an honest witness is persistent inter-statements (Arce & Fariña, 2005, 2013, 2014). Third, peripheral information can be categorised into contextual, temporal, idiosyncratic, perceptual and semantic information, as well as causal relationships (causality link). No other category of information was recorded by the coders, which validates the categorical system (construct validity). Fourth, the prevalence of peripheral information content us ranked in the following order: contextual, temporal, idiosyncratic, causal relations, and perceptual and semantic information. These results validate the Reality Monitoring model (Gancedo et al., 2021; Johnson & Raye, 1981): sensory information is characteristic of memories of lived events (external origin). Additionally, the results also validate the Story Model (Pennington & Hastie, 1992): parts of the narrative event are linked with causal relationships. Fifth, the prevalence of errors of commission (contradictions) and omission (appearance and disappearance of information) in peripheral information in honest memories is more than common ($.50 < p_o < .95$) and normal ($p_o \geq .95$), respectively. That is, the probability of contradictions

in the testimony of an honest witness in peripheral information is greater than 50% (almost always) and the probability of appearance and disappearance of peripheral information (errors of omission) in the sequence of testimony is normal (always). These results validate the 'central-peripheral hypothesis' in the persistence of information that established that peripheral information would not be consistent in the sequence of statements (persistence in judicial setting language) (Arce & Fariña, 2005, 2013, 2014). Sixth, errors of commission in peripheral information were significantly registered in temporal, contextual and idiosyncratic information. Seventh, omission errors are normal ($p_o \geq .95$) in contextual, temporal and idiosyncratic information; more than common ($.50 < p_o < .95$) in causal relations; and common ($p_o = .50$) in perceptual and semantic information. That is, the lack of consistency in the sequence of statements in the testimony of an honest witness is normal (always) in contextual, temporal and idiosyncratic information; common to normal (50% < and < 95%; almost always) in causal relationships; and common (= 50%; often) in perceptual and semantic information. Eighth, the first interview is more productive than the second, with approximately 10% of information lost in the second interview. This result validates the GES forensic technique that establishes that content analysis has to be carried out with the first one because the second one is less productive (Arce & Fariña, 2005, 2013, 2014).

The results of this study have implications for the forensic psychological practice of testimony assessment. In line with the study of the validity of GES evidence (testimony) (Arce & Fariña, 2005, 2013, 2014), testimony inconsistent in core elements of the event reported with a narrative interview without cross-examination is not valid evidence. These would probably be the consequence of external/implanted contamination (Davis & Loftus, 2007), as a result of interviewer malpractice or the use of inappropriate techniques of interview that contaminate testimony (Colwell et al., 2002; Memon et al., 2010). However, it would not be compatible with fabricated memories, as they are expected to be more persistent due to being learned (Trankell, 1972). Thus, lack of persistence in central details invalidates the testimony, but full persistence is of no use in endowing the testimony with evidential value (full persistent is not an indicator of a true account). Contrariwise, testimonies that is entirely consistent in peripheral information are not an honest recollection of lived events. Such errors always occur in uncontaminated honest accounts, so that perfect persistence in peripheral information will correspond to learned memories. Consequently, they would not be valid evidence. Therefore, in judicial judgment making about the credibility of a testimony (and in forensic testimony assessment too), the lack of persistence (inter-statements inconsistency) in peripheral information cannot be considered as a breach of the persistence in incrimination judicial criterion.

In conclusion, the results contradict the judicial criterion of persistence of testimony, according to which perfect persistence would endow testimony with greater credibility and accuracy. In fact, the lack of persistence in peripheral information corresponds to the nature of memory and behaviour of an honest witness. Regarding the errors reported by honest witness, this has no implications for testimony forensic evaluation, as it does not assess the number of errors made but based on content analysis criteria (these are independent of errors) determine if the witness memory meet sufficient criteria to support is from a self-experienced event.

The conclusions derived from this study are subject to limitations in their generalization. First, the employed testimony interview technique controlled for memory (evidence) contamination, so the results cannot be generalised to other types of interviews (Leal et al., 2023a), mainly to cross-examination of witnesses in judicial setting and to investigative police interview (Arce, 2017). Second, the memory assessment was directed at honest witnesses, specifically the claimant, so the results cannot be generalised to the testimony of defendants (Leal et al., 2023b). Third, the participants in the study were adults only, so the results should be generalized with caution to children, as they differ in recall and quality of content from adults (Li et al., 2023).

References

Amado, B. G., Arce, R., & Fariña, F. (2015). Undeutsch hypothesis and Criteria Based Content Analysis: A meta-analytic review. *European Journal of Psychology Applied to Legal Context, 7*(1), 3-12. https://doi.org/10.1016/j.ejpal.2014.11.002

Amado, B. G., Arce, R., Farina, F., & Vilariño, M. (2016). Criteria-Based Content Analysis (CBCA) reality criteria in adults: A meta-analytic review. *International Journal of Clinical and Health Psychology, 16*(2), 201-210. https://doi.org/10.1016/j.ijchp.2016.01.002

Arce, R. (2017). Análisis de contenido de las declaraciones de testigos: Evaluación de la validez científica y judicial de la hipótesis y la prueba forense. *Acción Psicológica, 14*(2), 171-190. https://doi.org/10.5944/ap.14.2.21347

Arce, R., & Fariña, F. (2005). Peritación psicológica de la credibilidad del testimonio, la huella psíquica y la simulación: El Sistema de Evaluación Global (SEG) [Psychological evidence in court on statement credibility, psychological injury and malingering: The Global Evaluation System (GES)]. *Papeles del Psicólogo*, *26*, 59-77. https://www.papelesdelpsicologo.es/pdf/1247.pdf

Arce, R., & Fariña, F. (2013). Evaluación psicológica-forense en casos de violencia de género: El Sistema de Evaluación Global (SEG). In S. P. Colín, E. García-López, & L. A. Morales (Eds.), *Ecos de la violencia, voces de la reconstrucción* (pp. 95-120). Servicio de Publicaciones de la Universidad de Morelia. http://dx.doi.org/10.13140/RG.2.1.1885.1040

Arce, R., & Fariña, F. (2014). Práctica de la prueba psicológica-forense: El Sistema de Evaluación Global (SEG). In C. Chan, C. Estrada, & F. J. Rodríguez (Eds.), *Aportaciones a la psicología jurídica y forense desde Iberoamérica* (pp. 47-61). Manual Moderno.

Arce, R., Fariña, F., Carballal, A., & Novo, M. (2009). Creación y validación de un protocolo de evaluación forense de las secuelas psicológicas de la violencia de género. *Psicothema, 21*(2), 241-247.

Arce, R., Farina, F., y Fraga, A. (2000). Género y formación de juicios en un caso de violación [Gender and juror judgment making in a case of rape]. *Psicothema, 12*(4), 623-628.

Arce, R., Fariña, F., & Seijo, D. (2013). Comparación entre un modelo categorial general (CBCA) y otro específico (SEG) a través del estudio de la validez incrementada en la discriminación entre realidad y simulación en casos de violencia de género. In F. Expósito, I. Valor-Segura, M. Vilariño, & A. Palmer (Eds.), *Psicología jurídica aplicada a los problemas sociales Colección Psicología y Ley, 11* (pp. 161-171). Sociedad Española de Psicología Jurídica y Forense. http://dx.doi.org/10.13140/RG.2.1.4612.4965

Arce, R., Seijo, A., & Novo, M. (2010). Testimony validity: A comparative study of legal and empirical criteria. *Psychology in Spain, 14*(1), 1-7.

Bardin, L. (1996). *El análisis de contenido* [Content análisis] (2nd ed.). Akal.

Colwell, K., Hiscock, C. K., & Memon, A. (2002). Interviewing techniques and the assessment of statement credibility. *Applied Cognitive Psychology, 16*, 287-300. https://doi.org/10.1002/acp.788

Corrás, T., Seijo, D., Fariña, F., Novo, M., Arce, R., & Cabanach, R. G. (2017). What and how much do children lose in academic settings owing to parental separation? *Frontiers in Psychology, 8*, 1545. http://doi.org/10.3389/fpsyg.2017.01545

Daubert vs. Merrell Dow Pharmaceuticals, 509 U.S. 579 (1993).

Davis, D., & Loftus, E. F. (2007). Internal and external sources of misinformation in adult witness memory. In M. P. Toglia, J. D. Read, D. F. Ross, & R. C. Lindsay (Eds.), *The Handbook of Eyewitness Psychology: Volume I: Memory for Events*. LEA.

Davis, M. R., McMahon, M., & Greenwood, K. M. (2005). The efficacy of mnemonic components of the cognitive interview: Towards a shortened variant for timecritical investigations. *Applied Cognitive Psychology, 19*, 75-93. https://doi.org/10.1002/acp.1048

Fisher, R. P., Geiselman, R. E., & Amador, M. (1989). Field test of the cognitive interview: Enhancing the recollection of actual victims and witness of crime. *Journal of Applied Psychology, 74*, 722-727. https://doi.org/10.1037/0021-9010.74.5.722

Fisher, R. P., & Geiselman, R. E. (1992). *Memory enhancing techniques for investigative interviewing: The cognitive interview*. Charles C. Thomas.

Gancedo, Y., Fariña, F., Seijo, D., Vilariño, M., & Arce, R. (2021). Reality monitoring: A meta-analytical review for forensic practice. *European Journal of Psychology Applied to Legal Context, 13*(2), 99-110. https://doi.org/10.5093/ejpalc2021a10

Johnson, M. K., & Raye, C. L. (1981). Reality Monitoring. *Psychological Review, 88*, 67-85. https://doi.org/10.1037/0033-295X.88.1.67

Leal, S., Vrij, A., Deeb, H., Burkhardt, J., Dabrowna, O., & Fisher, R. P. (2023a). Verbal cues to deceit when lying through omitting information: Examining the effect of a model statement interview protocol. *European Journal of Psychology Applied to Legal Context, 15*(1), 1-8. https://doi.org/10.5093/ejpalc2023a1

Leal, S., Vrij, A., Deeb, H., Dabrowna, O., & Fisher, R. P. (2023b). Combining the Devil's Advocate Approach and Verifiability Approach to assess veracity in opinion statements. *European Journal of Psychology Applied to Legal Context*, *15*(2), 53-61. https://doi.org/10.5093/ejpalc2023a6

Ley Orgánica 3/2018, de 5 de diciembre, de Protección de Datos Personales y Garantía de Derechos Digitales (2018). *Boletín Oficial del Estado, 294*, 119788-119857. https://www.boe.es/boe/dias/2018/12/06/pdfs/BOE-A-2018-16673.pdf

Li, C., Otgaar, H., van Daele, T., Muris, P., Houben, S. T., & Bull, R. (2023). Investigating the memory reports of retractors regarding abuse. *European Journal of Psychology Applied to Legal Context*, *15*(2), 63-71. https://doi.org/10.5093/ejpalc2023a7

Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Sage.

Memon, A., Meissner, C. A., & Fraser, J. (2010). Cognitive interview. A meta-analytic review and study space analysis of the past 25 years. *Psychology, Public Policy, and Law, 16*, 340-372. https://doi.org/10.1037/a0020518

Novo, M., & Seijo, D. (2010). Judicial judgement-making and legal criteria of testimonial credibility. *European Journal of Psychology Applied to Legal Context, 2*, 91-115.

Nunnally, J.C. (1978). *Psychometric theory (2nd ed.)*. McGraw-Hill

Odinot G, Memon A, La Rooy D., & Millen A (2013). Are two interviews better than one? Eyewitness Memory across repeated cognitive interviews. *PloS ONE, 8*(10), e76305. https://doi.org/10.1371/journal.pone.0076305

Oberlader, V. A., Naefgen, C., Koppehele-Gossel, J., Quinten, L., Banse, R., & Schmidt, A. F. (2016). Validity of content-based techniques to distinguish true and fabricated statements: A meta-analysis. *Law and Human Behavior*, *40*(4), 440-456. https://dx.doi.org/10.1037/lhb0000193

Pennington, N., & Hastie, R. (1992). Explaining the evidence: Tests of the Story Model for juror decision making. *Journal of Personality and Social Psychology, 62*(2), 189-206. https://doi.org/10.1037/0022-3514.62.2.189

Porter, S., & ten Brinke, L. (2010). The truth about lies: What works in detecting high-stakes deception? *Legal and Criminological Psychology, 15*, 57-75. https://doi.org/10.1348/135532509X433151

Sanmarco, J., Selaya, A., Marcos, V., & Montes, Á. (2023). Contrasting the efficacy of the content analysis categories of the Global Evaluation System to discern between experienced memories and video observed memories. *Revista Iberoamericana de Psicología y Salud*, *14*(2), 55-67. https://doi.org/10.23923/j.rips.2023.02.066

Sentencia del Tribunal Supremo 1229/2017, Sala de lo Penal, de 29 de Marzo de 2017. https://www.poderjudicial.es/search/AN/openDocument/ea9665d733a57b7e/20170410

Steller, M. (1989). Recent devekopments in statement analysis. In J. C. Yuille (Ed.), *Credibility assesment* (pp.135-154). Kluwer Academic Publishers.

Steller, M., & Böhm, C. (2006). 50 años de jurisprudencia del Tribunal Supremo alemán sobre psicología del testimonio. Balance y perspectiva [50 Years of German Supreme Court Case Law on witness psychology. Balance and perspective]. In T. Fabian, C. Böhm & J. Romero (Eds.), *Nuevos caminos y conceptos en la psicología jurídica* (pp. 53-77). Lit Verlag.

Steller, M., & Kohnken, G. (1990). Criteria-based statement analysis. In D. C. Raskin (Ed.), *Psychological Methods in Criminal Investigation and Evidence*. Springer-Verlag.

Trankell, A. (1972). *Reliability of evidence. Methods for analyzing and assessing witness statements*. Beckman.

Tversky, A. (1977). Features of similariy. *Psychological Review, 84*, 327-352. https://doi.org/10.1037/0033-295X.84.4.327

Undeutsch, U. (1967). Beurteilung der glaubhaftigkeit von zeugenaussagen [Assessing the credibility of witness statements]. In U. Undeustch (Ed.), *Handbuch der psychologie, Bd.11: Forensic psychologie* (pp. 26-181). Hogefre.

Undeutsch, U. (1989). The development of statement reality analysis. In J. Yuille (Ed.). *Credibility assessment* (pp.101-119). Kluwer Academic Publishers.

Vilariño, M., Amado, B. G., Vázquez, M. J., & Arce, R. (2018). Psychological harm in women victims of intimate partner violence: Epidemiology and quantification of injury in mental health markers. *Psychosocial Intervention, 27*(3), 145-152. https://doi.org/10.5093/pi2018a23

Vilariño, M., Novo, M., & Seijo, D. (2011). Estudio de la eficacia de las categorías de realidad del testimonio del Sistema de Evaluación Global (SEG) en casos de violencia de género. *Revista Iberoamericana de Psicología y Salud, 2*, 1-26.

Vrij, A., Granhag, P. A., & Porter, S. (2010). Pitfalls and opportunities in nonverbal and verbal lie detection. *Psychological Science in the Public Interest, 11*, 89-121. https://doi.org/10.1177/1529100610390861

Walsh, D. W., & Milne, R. (2008). Keeping the PEACE? A study of investigative interviewing practices in the public sector. *Legal and Criminological Psychology, 13*(1), 39-57. https://doi.org/10.1348/135532506X157179

Wicker, A. W. (1975). An application of the multitrait-multimethod logic to the reliability of observational records. *Personality and Social Psychology Bulletin, 4,* 575-579. https://doi.org/10.1177/014616727500100405

Yuille, J. C., Hunter, R., Joffe, R., & Zaparniuk, J. (1993). Interviewing children in sexual abuse cases. In G. Goodman & B. Bottoms (Eds.), *Child victims, child witnesses: Understanding and improving children's testimony* (pp. 95-115). Guilford Press.

Funding: This research has been partially sponsored by a grant of the Spanish Ministry of Science and Innovation (Code: PID2020-115881RB-I00); a grant to Álvaro Montes from the Spanish Ministry of Universities under the program "Ayudas para la Formación de Profesorado Universitario" (Code: FPU20/02169); and a grant to Blanca Cea from the Spanish Ministry of Universities under the program "Ayudas para Contratos Predoctorales para la Formación de Doctores" (Code: PRE2021-100192)

Data Availability: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest: The authors declare that there is no conflict of interest.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Institutional Review Board Statement: This study was approved by the Comité of Bioética of the University of Santiago de Compostela (Code: USC 35/2023).