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Cognitive Bias and Judicial Decisions

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Abstract

It seems reasonable that the judicial decisions undertaken by judges and panels of judges are based on formal reasoning. Nevertheless, a study of Spanish sentencing has revealed that most sentences, contrary to expectation, are based on biased reasoning, that is, informal reasoning. Thus, the content analysis of 555 sentences showed that most legal judgements (74.95%) rest on informal reasoning i.e., cognitive biases: information salience and availability, preconceived ideas or theories concerning people or events, and the phenomena of anchoring and perseverance. Furthermore, the underlying mechanisms in terms of cognitive processing in the reconstruction of events were evaluated in relation to each source of bias. This line of investigation opens a new field that complements the guidelines in that it reveals considerable bias in the reasoning behind the motivation. As a possible solution, we propose that judges should be trained to identify the sources of bias in order to mitigate metacognitive deficits inherent in informal reasoning (Perkins, 1989). That is, to make them aware of bias to ensure greater objectivity in legal decision-making.

Keywords: judges, judicial decisions, cognitive bias, sentencing, judicial reasoning.

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Introduction

In 1977, Ross classified the sources of bias that influence human judgements into motivational and cognitive. Motivational bias satisfies individual needs and desires whereas cognitive bias arises from limitations in human information-processing. Motivational bias tends to lead to irrational judgements while cognitive bias involves, due to the limitations of information-processing strategies, judgements that systematically deviate from accepted norms or standards. According to Kruglanski and Azjen (1983) three sources of cognitive bias are involved in attribution and prediction: information salience and availability, preconceived ideas or theories concerning people or events, and the phenomena of anchoring and perseverance.

Information salience and availability

The nexus between causal attribution and saliency, proposed by Heider (1958) and corroborated by Taylor and Fiske (1978), suggests that inferencing is based on information saliency and availability. Thus, the more available, probable, frequent, and salient the information is at the time of judgement-making, the more it will guide causal inferencing (Plous, 1993).

On occasions, the judgement-maker makes inferences about a person's behaviour on the basis of sampling bias. That is, when the sample of the information available is not representative of the entire population. Consequently, a judgement-maker may erroneously infer, bearing in mind atypical behaviour, personal dispositions.

Another potential source of bias derives from selective recall and perception. Taylor and Fiske (1975), having reviewed and integrated the literature, proposed that judgement-makers tend to look for a sole, sufficient, and salient explanation of behaviour, and that causal attributions are often modulated by salient stimuli. Even if all the relevant information is readily available to judgement-makers, they may selectively focus on those characteristics of the situation that are perceptually salient, and overestimate the importance of this information in later causal explanations.

A further source of bias related to information saliency is the "fundamental error of attribution", also known as the Jones-Harris' effect, which exaggerates the relevance of dispositional factors at the expense of situational or environmental factors in explaining behaviour (Jones & Harris, 1967). Some authors claim that the "fundamental error of attribution" can be explained in perceptual processing terms. That is, the person's behaviour attracts and absorbs the judgement-maker's attention, which will cause an overestimation of the causal importance of the person's behaviour in comparison to other less salient factors (Fiske & Taylor, 1991). Another explanation lies in the internalisation of social norms, which implies that internal attributions tend to be more favourably evaluated than external ones. Both explanations have been experimentally corroborated (Sherman & Corty, 1984). This source of bias is not systematic and depends on the judgement-making demands, such as getting a general impression of the subject, comparing people or predicting behaviour (Papastamou, 1989). In cognitive terms, this implies that if a person's behaviour is salient, causal inferencing linked to the person's behaviour will be more available and prominent in the explanations (Moore et al., 1979). Moreover, implicit theories of people imply that

dispositional causes will be overestimated in the explanation of behaviour. Though it has often been argued that the fundamental error of attribution is not as fundamental as previously thought, the observation of negative behaviour frequently over-attributes dispositional factors (i.e., attitudes, skills, personality traits) (e.g., Tetlock, 1985). The evaluation of negative behaviour is central to judicial judgement-making. Thus, Ashworth (1984) reported that the vast majority of judges believed that the factors that inhibited most people from committing crime were their moral beliefs and the fear of social stigma.

Selective recall is also another source of cognitive bias, which is related to information saliency and availability. As Tversky and Kahneman (1973) have pointed out, a person uses the heuristic of availability when they evaluate the frequency or value of an event on the basis of examples that are readily accessible. Thus, in the legal context, judgements are influenced by the ease with which one can draw on examples. Nevertheless, selective recall does not imply that people cannot recover dissonant information, but rather that it is not used in the explanation of the events due to the task demands (Bekerian & Dennet, 1988; Arce, Fariña & Novo, 1997).

Preconceived ideas or theories about people and events

Preconceptions guiding the use of information in the prediction and explanation of events incline people towards certain hypothesis and information, and predispose them to adopt intuitive ideas about an event or behaviour at the expense of relevant information (e.g., Bar-Hill, 1980; Kelley, 1972). Preconceptions are said to arise from three sources: presumed covariation, representativeness, and causal theories.

The classical Asch (1946) studies on the formation of impressions (i.e., context effect, central traits) have revealed that intuitive comprehension of the relations between variables can exert an influence on our judgements. Kelley (1972) describes a pairing and grouping scheme to represent preconceived ideas related to the covariation between events. An example of the covariation between personality traits and behaviour that can lead to bias and errors is the illusory correlation (Chapman & Chapman, 1969), referring to the erroneous belief that two unrelated variables are in fact related.

The heuristic of representativeness (Kahneman & Tversky, 1973) is another source of bias that rests on preconceived theories or ideas. Succinctly, when people have to evaluate the probability of a fact such as whether an object A belongs to a class B, they tend to use this heuristic. For example, "when A is highly representative of B, the probability that A originates from B is judged to be high. On other hand, if A is not similar to B, the probability that A originates from B is judged to be low" (Tversky & Kahneman, 1974/1986 p. 39). Though it provides a quick solution, it entails bias such as: neglecting prior odds, disregarding the size of the sample, insufficient regressive judgement-making, underestimating the predictive value of evidence; or ignoring the fact that information stored in memory is not always reliable.

Causal theories underline the role of causal schemas in the formation and revision of beliefs (e.g., Tversky & Kahneman, 1980). The causal scheme presupposes a preconception about how two or more causes interact and the effect they produce (Kelley & Michela, 1980). That is, people may infer that several separate factors cause something to occur; the existence of one of these factors may lead one to imply the other(s). Kelley (1972) model describes two causal schemes: multiple causes and

sufficient multiple causes. Whereas Kelley underlines the economic function of these types of schemes, Kahneman and Tversky (1973) emphasize the nature of them as a potential source of bias in judgement making.

Anchorage and adjustment

The last major source of cognitive bias stems from the anchorage and adjustment heuristic. Information saliency and availability or preconceived ideas can drive an initial hypothesis, which may serve as an anchor (Tversky & Kahneman, 1974/1986) that restricts cognitive activity or serves as a cognitive set (Azjen, Dalto & Blyth, 1979) to guide the interpretation of the new information (e.g., Kaplan, 1982).

Judicial systems assume algorithmic strategies that one takes into account all the possibilities of the problem. Nevertheless, Saks and Kidd (1986) have pointed out that judicial decision making is a good example where the probabilistic and uncertain nature of the task gives rise to the use of heuristics or simplification tools that reduce the complexity of the information required for decision making. This had led these authors to design a judicial decision-making model based on heuristics. Likewise, Fitzmaurice and Pease (1986) have proposed a model based on bias in judgement-making. In line with these studies, the present work aims to evaluate if judicial decisions are mediated by heuristics strategies that lead to bias and error or by algorithmic ones (Kruglanski & Azjen, 1983). Thus, our aim is to search for cognitive bias in judges' written judgements as well as identifying the likely cognitive activity on which they are based. In line with the scientific literature, motivational bias will be ignored in this paper since it responds to very irrational tendencies, and is not contemplated in judicial reasoning.

Method

Protocols

A total of 555 criminal judgements (in an inquisitorial system) were selected from the Appeal and High Criminal Courts of the Autonomous Community of Galicia, spanning the period from 1980 to 1995. As for the verdict, 457 (82.3%) were guilty, 93 (17.7%) not-guilty, and 5 (.9%) of cases were not admitted for lack of evidence and were recodified as not guilty. Disregarding the latter, guilty judgements were significantly greater, $\chi^2(1)= 240.9$; $p<.001$. 172 judgements were High Court (31.0%) and 383 (69.0%) Appeal Court.

Table 1

Crime	Not guilty	Guilty
Minor offences	21.1%	78.9%
Drug and public health offences	21.95%	78.05%
Traffic offences	22%	78%
Grievous bodily harm (GBH)	27.41%	72.59%
Crimes against property	30.66%	69.34%
Fraud	40%	60%

In terms of the case type, 139 (20.62%) were grievous bodily harm (GBH); 75 (11.12%) crime against property; 67 (9.94%) traffic offences; 41 (6.08%) drug and public health offences; 40 (5.93%) minor offences i.e., threats, resisting arrest; and 40 (5.93%)

"fraud**".** A glance at Table 1 shows the probability of guilty verdicts in relation to the nature of the offence.

Analysis of protocols

The protocols, that is, the judgements[1], consist of two sections, the first referring to the facts, and the other to legal considerations. Both have been included in the analysis.

The first objective of the analysis of these protocols was to search for cognitive bias. Definitions and examples are presented as follows:

Information saliency and availability[2]

Though all of the relevant information may be available, the judgement-maker may only focus on some of the salient characteristics or data, and fail to consider other relevant information. An example of selective attention is, *"...the victim was left with a "C" shaped scar that will be clearly visible if he were to go bald...".* Yet the scar was not really visible, and the defence's allegations of self-defence were disregarded without any argumentation. Thus, the judgement-maker focuses on specific information neglecting other relevant evidence. A pattern of "fundamental error of attribution" is: *"..Bearing in mind the dangerous means employed (a steel pitch fork), and the action of hitting Mr. R. in the area of the heart, confirms the intention of grievous bodily harm which excludes the lack of responsibility and any mitigating circumstances proposed by the defence..."*. In this example, the judge is overestimating the personal disposition, disregarding situational factors indicative of self-defence. Moreover, selective recall was evaluated by referring to previous cases, in terms of the law of precedence.

Preconceptions

Preconceptions are preconceived ideas concerning the covariation of events, causal theories or representativeness; that is, when the judgement-maker has preconceived ideas of how things occur and how things normally occur. A causal example is: *" the accused at the time of arrest for drunken driving, was unable to park the car near the curve, refused to be breathalysed and insisted that if he were to be breathalysed it should be done not in Lugo but in Castroverde[3]. This together with the fact that the accused had ingested wine and gin-tonic before being stopped convinces the court that ..."*. An example of representativeness[4] is: *"...the events occurred in the*

[1] The term judgement refers to the judge's or court's written decision. In some countries the term sentence is used, whereas in others the term sentence is used only to refer to a guilty verdict. In this paper, the term judgement is used to refer to the judge's or court's written decisions whether it be a guilty or not guilty verdict.

[2] Selective recall and sample bias were not detected in any of the sentences.

[3] Lugo was 5 km away, but Castroverde was over 30 km away.

[4] A valid categorical system requires the categories to be mutually exclusive (Weick, 1985). Thus, it was necessary to delimit perfectly the bias in the sample and the representativeness. The difference lies in the origin of the information. Representativeness is when the origin of the bias stems from the decision maker's own ideas or theories in which case this would be an example of a sample bias derives from the evidence.

city of Lugo, but the accused is from Cambados, which supports the judge's view[5]*...".* Finally, an example of a covariation model is as follows: *"given that he is short sighted, and at the time he was not wearing his glasses, he did not realise what he was picking up from the counter..."*.

Anchorage

Anchorage was defined as the prosecution's request in terms of a judgement (Garrido & Herrero, 1997), or, in the cases of an appeal, the judge's previous decision (Fitzmaurice & Pease, 1986). Anchorage was measured via the decision to incarcerate or the length of the sentence. Thus, anchorage was measured via the initial and direct estimates (Saks & Kidd, 1986; Wagenaar, 1995).

Since the aim was to evaluate possible differences in cognitive processing in the reconstruction of events, a system of categories was used that has proven to be useful and reliable in other studies (i.e., Fariña, Fraga and Arce, 2000). This system enables us to examine the underlying processes that influence judgement making. There are two category lists, one referring to general and the other to specific cognitive activity. The former deals with the number of words, general and specific thoughts, (the unit of analysis is the grammatical sentence, and it is specific when it is related to the case and general when it does not). Given that specific cognitive activity interacts with the content of the case in question, the two coders were previously asked to codify a list of categories obtained from other studies (i.e., Fariña, Fraga and Arce, 2000). Moreover, a procedure based on successive approximations was used to identify new categories related to the case in question. The list and description of the productive categories employed in the present study are as follows:

IDIOSYNCRATIC INFORMATION. An account of the number of references a judge makes to his/her internal state, cognitive processes and/or emotions.

DESCRIPTION OF INTERACTIONS. Total number of descriptions of interrelated actions and reactions.

REPRODUCTION OF CONVERSATIONS. Total number of virtual reproductions of expressions, certain manners of speaking or other people's vocabulary.

CONTEXTUAL INCRUSTATION. Total number of embeddings related to the law of precedence and jurisprudence.

AMOUNT OF LEGAL DETAILS An account of the number of legal references mentioned in the judgement.

CONTEXTUAL INFORMATION. Total number of references made to places, dates, time periods, etc.

ATTRIBUTIONS ON THE ACCUSED'S MENTAL STATE. An account of the references made by the judge to the mental state or motives of the accused.

[5] Cambados is a city well known for being one of the centres for drug-dealing in Spain

ATTRIBUTIONS ON THE PLAINTIFF'S MENTAL STATE. An account of the references made by the judge to the mental state or motives of the plaintiff.

PHYSICAL CAUSAL RELATIONSHIPS. Total number of physical-causal events, when there is a presumed nexus between two physical events.

TEMPORAL CAUSAL RELATIONSHIP. Total number of temporal-causal relationships, when there is the existence of temporal continuity between two events.

NUMBER OF PRO-ACCUSED STATEMENTS.

NUMBER OF NEUTRAL STATEMENTS.

NUMBER OF STATEMENTS AGAINST THE ACCUSED.

NUMBER OF WORDS.

NUMBER OF GENERAL STATEMENTS, NOT RELATED WITH THE EVIDENCE.

NUMBER OF SPECIFIC STATEMENTS, RELATED WITH THE EVIDENCE.

An analysis of the internal consistency of the scales showed an alpha of crombach of .8368 for the general cognitive activity and .7663 for the specific cognitive activity.

Training of encoders

The two coders who participated in the study were trained, and the correlations and concordance index between codes served to contrast and correct any bias. Codings that did not coincide were discussed in order to homogenise the criteria. Both encoders had previous experience in other studies that had used the same coding system with similar categories (Arce et al., 1995).

Reliability

Each encoder analysed half of the protocols in search of cognitive biases and the categories that measure cognitive processing. One week after finishing the original encoding, 10% of the protocols were encoded again in order to determine the between- and within-encoder consistency. The consistency was calculated using the Kappa Statistic for the categorical variables and the correlation for the discrete ones[6] (see Table 2).

[6]We should bear in mind that this index is not accurate since it is not sensitive to the correspondence of the counts, thus the exact correspondence of the counts was verified. With this safeguard, Carrera and Fernández-Dols (1992) report that a correlation greater than .70 is reliable.

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Table 2. *Within- and between-encoder consistency in "cognitive biases".*

Cognitive bias	between encoders 1-2	between encoders 2-1	within encoder 1	within encoder 2
Anchorage	1.00*	1.00*	1.00*	1.00*
Saliency and availability	1.00*	1.00*	1.00*	1.00*
Preconceptions	1.00*	1.00*	1.00*	1.00*

Note: *p<.001

Having contrasted the encoder scores (see Tables 2 and 3), the measurements appear to be consistent within- and between-encoders for both cognitive activity, and detection of cognitive biases.

Table 3. *Between- and within-consistency of cognitive processes.*

Variables	r_{12}	r_{21}	r_1	r_2
Abstracts statements	.995*	.993*	1.00*	.997*
Amount of legal details	.998*	.989*	.997*	.998*
Attributed accused mental state	1.00*	1.00*	1.00*	.998*
Attributed victim mental state	1.00*	1.00*	1.00*	.990*
Contextual incrustation	1.00*	1.00*	1.00*	1.00*
Contextual information	.962*	.947*	.992*	.992*
Description of interactions	.995*	.985*	1.00*	.999*
Idiosyncratic information	.997*	1.00*	1.00*	1.00*
Neutral statements	.996*	1.00*	.988*	1.00*
Physical causal relations	.875*	.980*	1.00*	1.00*
Pro-accused statements	1.00*	.822*	.997*	.997*
Related statements	.994*	.998*	1.00*	.999*
Reproduction of conversations	1.00*	1.00*	1.00*	1.00*
Specific statements	.992*	.846*	.999*	.999*
Statements against the accused	1.00*	.999*	.939*	.982*
Temporal causal relations	.994*	.975*	.997*	.998*
Words	.840*	1.00*	1.00*	1.00*

Note: *p<.001

Furthermore, the encoders have been shown to be consistent in other contexts (Arce et al., 1995); thus the results can be defined as reliable (Wicker, 1975).

Data analysis

A multivariate analysis of variance (MANOVA) was carried out to assess cognitive activity associated to the presence vs. absence of the cognitive bias in sentencing. Among others, the reasons for preferring MANOVA to other tests were that it takes into account the intercorrelations among variables; keeps the overall α level under control; gives univariate analysis (Stevens, 1986 p. 143). As is well known, the analysis of variance is a robust test, in particular with similar sized groups (large/small <1.5). Though many authors do not consider this to be of importance (Stevens, 1986), the absence of homogeneity of variance can lead to important deviations in the

significance of the results. Thus, if the variability is greater in the small group, the F is liberal. In contrast, if the variance is greater in the large group, the statistic is conservative. In our study, some comparisons are made between two different sized groups. Consequently, as a safeguard, the variables were transformed using the square root[7] to homogenise the variances (Dixon & Massey, 1983, pp. 373). As a second safeguard, the theoretical F of Box"[8] was used to confirm the correct acceptance or rejection of the hypothesis. Thus, if this were smaller than the empirical the alternative hypothesis was accepted, and vice versa (Palmer, 1996). The safeguards revealed no significant change in the results or in the regions of rejection or acceptance. In relation to multivariate tests the Pillia-Bartlett trace was used given that it is more robust to the effects of heterogeneity of the variance matrices (Olson, 1976).

Results

Contingency of cognitive bias

Table 4 shows the frequencies of the presence/absence of cognitive biases in judgements. In the Spanish context, it appears that on the whole, the vast majority of judgements (74.95%) contained cognitive bias. Over half of the judicial decisions were based on anchorage (63%), about 16% on preconceived ideas or theories, and 9% on saliency and availability of the information.

Table 4. *Contingency of Cognitive Biases.*

	Presence		Absence	
Cognitive bias	Frequency	Percentage	Frequency	Percentage
Saliency and availability	50	9	505	90
Preconceptions	88	15.9	467	84.1
Anchorage	353	63.6	202	36.4

Cognitive biases and verdict

Anchorage tended to be systematically associated to guilty verdicts, $\chi^2(1, n=550)= 12.57728$; $p<.001$; phi= -.15122. That is, 87.4% of the guilty verdicts were linked to anchorage whereas decisions with no anchorage were observed in 75.6% of guilty verdicts. The relationship between anchorage and a guilty verdict lies at the very heart of the judicial process itself, since the process must commence with a firm accusation against the accused, which is the initial hypothesis of a guilty verdict that will serve as anchorage. When an initial hypothesis serves as anchorage i.e., as the point of departure on which to base the final estimates, it usually leads to bias or error of judgement. As Ross and Lepper (1980) have pointed out, the initial hypothesis perseveres in spite of the existence of information to the contrary. In short, the findings suggest that this bias is used to subordinate more objective means of information processing such as normative inferencing models.

[7] Nevertheless, the means presented in the text and tables are raw data.
[8] D.F.=1;n-k/k

The source of bias "preconceived ideas or theories about people or events" tends to be associated with a significant reduction in the number of guilty verdicts, $\chi^2(1, n=550)= 4.881$; $p<.05$; phi= -.094. It is worth noting that most of the decisions were free of bias based on preconceived ideas leading to 84.6% of guilty verdicts, which fell to 75% when the judgement-maker based his/her judgements on preconceived ideas. Initially, one would not expect a systematic tendency associated between this source of bias and the verdicts. The most reasonable explanation is the lower costs involved in a not-guilty verdict, that can be sustained with weak arguments derived from preconceived theories or ideas. Nevertheless, further research is required to determine the relationship between not-guilty verdicts and the judges' preconceptions.

As for "information saliency and availability", this cognitive bias was not systematically related to any particular judgement, $\chi^2(1, n=550)= .374$; ns.

Anchorage and cognitive activity

In relation to the factor anchorage (presence vs. absence), the results exhibit a multivariate effect in general cognitive activity, $F_{multivariate}(3,551)=6.44164$; $p<.001$. The univariate effects (see Table 5) show that in judgements without anchorage there is a greater number of words, and more reasoning related to the evidence in comparison with the judgements guided by the bias anchorage. In other words, the judgements without anchorage display more cognitive activity in order to explain the judgement reached. Thus, anchorage involves cognitive saving in motivating the judgement.

Table 5. *Univariate effects in the dimension "general cognitive activity"*.

Variable	MS	F	p	eta^2	M_0	M_1
General statements	.89668	.00826	.928	.00001	2.48020	2.56374
Specific statements	18263.6420	12.98235	.000	.02294	48.02475	36.10198
Words	3326857.90	6.25721	.013	.01119	755.95050	595.03399

Note: D.F. (1,553); M_0= mean of the judgements without the cognitive bias "anchorage"; M_1= mean of the judgements driven by "anchorage".

Similar to general cognitive activity, the results show significant multivariate differences in specific cognitive activity mediated by the anchorage factor $F_{multivariate}(13,541)= 6.81226$; $p<.001$. Likewise, at a univariate level, some variables appear to be mediated by this factor (see Table 6): physical and temporal causal relations, the number of legal details, neutral and pro-accused reasoning, description of interactions, contextual information, reproduction of conversations, and attributions to the mental state of the plaintiff. Thus, the absence of this bias is linked to more attributions to the mental state of the plaintiff, more descriptions of the interactions, legal details, contextual information, neutral propositions, pro-accused reasoning, to the establishment of more physical and temporal causal relations, and the reproduction of conversations. In other words, the absence of anchorage implies judgements which are more "driven to the facts" (contextual information, description of interactions, and reproduction of conversations); more "legally motivated" (legal details); and "causally guided" (temporal and physical causal relations). Furthermore, the absence of anchorage is closely linked to "attributions to the plaintiff's mental state", which have been identified as a tool to reject a guilty verdict on the basis of the plaintiff's mental disorder.

The findings suggest that judgements based on anchorage rest on the process, evidence, categorization and reconstruction of the prosecution, or in the case of appeal courts the previous judge's decision; whereas, the absence of anchorage requires a double process: rejecting anchorage and formulating a new judgement.

Table 6. *Univariate Effects in the Dimension "Specific Cognitive Activity".*

Variable	MS	F	p	eta^2	M_0	M_1
Amount of legal details	1994.56544	47.22616	.000	.07868	7.8713	3.8470
Attributed accused mental state	34.39664	2.45475	.118	.00442	2.20	1.68
Attributed victim mental state	10.51268	8.25193	.004	.01470	.54	.26
Contextual incrustation	.28392	1.66432	.198	.00300	1.81	1.76
Contextual information	963.56969	11.51626	.001	.02040	8.06	5.32
Description of interactions	981.25596	7.41647	.007	.01323	9.40	6.63
Idiosyncratic information	.34855	.08393	.772	.00015	.77	.82
Neutral statements	20154.3803	10.19243	.001	.01810	33.54	21.01
Physical causal relations	11.16256	5.94527	.015	.01064	.9009	.6062
Pro-accused statements	1284.15049	21.55559	.000	.03752	5.49	2.32
Reproduction of conversations	128.27396	6.71753	.010	.01200	2.06	1.06
Statements against the accused	138.88734	.38698	.534	.00070	14.03	15.07
Temporal causal relations	1069.15601	7.95643	.005	.01418	9.38	6.50

Note: D.F. (1,553); M_0= mean of the judgements without "anchorage"; M_1= mean of the judgements driven by the cognitive bias "anchorage".

Salience and availability

The bias "salience and availability" mediates significant multivariate differences in general cognitive activity, $F_{multivariate}$ (3,551)= 13.65; p<.001. Univariate effects (see Table 7) reveal that judgements guided by the cognitive bias "information salience and availability" appear more closely connected to the evidence i.e., reasoning related to the case. Thus, it appears that there is no expected cognitive saving in the judgement.

Table 7. *Univariate effects in the dimension "general cognitive activity".*

Variable	MS	F	p	eta^2	M_0	M_1
General statements	39.391	.363	.547	.000	2.45	3.38
Specific statements	8230.612	5.776	.017	.010	39.23	52.68
Words	57215.936	.106	.744	.001	650.41	685.88

Note: D.F.(1,553); M_0= mean of the judgements without information "saliency and availability "; M_1= mean of the judgements driven by information "saliency and availability".

Likewise, significant multivariate differences were observed in specific cognitive activity modulated by the "salience and availability" factor, $F_{multivariate}$(13,541)=4.214; p<.01. As for the univariate effects (see Table 8), differences were only observed in the variable pro-accused arguments. In other words, the presence of this bias tends to be associated more with pro-accused statements, which favour the accused. Nevertheless, this does not increase the number of not guilty verdicts as would be expected. Thus, The findings confirm that greater activity in favour of the accused is

related to source of bias "salience and availability", but this is not reflected in systematically biased not guilty judgements.

Preconceived ideas or theories of people or events

The factor "preconceived ideas or theories" (presence vs. absence) mediates significant differences in general cognitive activity, $F_{multivariate}(3,551)=6.857$; $p<.001$. The univariate effects (see Table 9) revealed that when this source of bias was detected in the formulation of judgements, judges resorted more to specific reasoning; that is to say, judgements were more connected to the evidence, and a greater number of words.

Table 8. *Univariate Effects in the Dimension "Specific Cognitive Activity".*

Variable	MS	F	p	eta^2	M_0	M_1
Amount of legal details	9.643	.210	.647	.000	5.240	5.700
Attributed accused mental state	18.878	1.345	.247	.002	1.816	2.460
Attributed victim mental state	3.147E-03	.002	.961	.000	.368	.360
Contextual incrustation	2.159E-04	.001	.972	.000	1.782	1.780
Contextual information	104.265	1.223	.269	.002	6.186	7.700
Description of interactions	169.588	1.268	.261	.002	7.469	9.400
Idiosyncratic information	2.531	.610	.435	.001	.784	1.020
Neutral statements	2032.406	1.011	.315	.002	24.976	31.66
Physical causal relations	1.523	.804	.370	.001	.697	.880
Pro-accused statements	418.810	6.850	.009	.012	3.206	6.24
Reproduction of conversations	24.581	1.275	.259	.002	1.495	.760
Statements against the accused	300.655	.838	.360	.002	14.469	17.04
Temporal causal relations	29.175	.214	.644	.000	7.479	8.280

Note: D.F. (1,553); M_0= mean of the judgements without information "saliency and availability"; M_1= mean of the judgements driven by information "saliency and availability ".

Table 9. *Univariate Effects in the Dimension "General Cognitive Activity".*

Variable	MS	F	p	eta^2	M_0	M_1
General statements	18.555	.171	.679	.000	2.454	2.955
Specific statements	27776.946	19.989	.000	.035	37.370	56.739
Words	10365247.743	19.973	.000	.035	594.278	968.420

Note: D.F.(1,553); M_0= mean of the judgements without preconceptions; M_1= mean of the judgements driven by preconceptions.

Similarly, the preconception factor also modulates significant differences in specific cognitive activity, $F_{multivariate}(13,541)=5.379$; $p<.001$. As for the univariate effects (see Table 10), these indicate that the reproduction of conversations, contextual information, references to the mental state of the plaintiff and the accused, and neutral reasoning are more frequent judgements driven by preconceptions. In contrast, preconceived written judgements contained fewer contextual incrustations. In other words, they were more driven "to the facts" i.e., involving more conversation and contextual information. These judgements were not "driven to the verdict" (with more neutral reasoning, with no significant reasoning either in favour or against the accused). On the other hand, preconceived judgements were based more on inferences, without

the support of expert evidence, about the mental state of the accused and plaintiff. Moreover, preconceived judgements are not as "legally driven" since they are grounded on weak jurisprudence i.e., with less contextual incrustation.

Discussion

We should bear in mind that the results may not reflect the full extent of cognitive bias due to the possible limitations of our detection instruments. For example, content analysis of the judgements may not reveal the full impact of bias mediated by information saliency and availability. Furthermore, the results can not be generalised to cover other legal systems, since they are derived from an inquisitorial system, with a specific jurisprudence and judgement-making context. Moreover, bias inferencing need not necessarily entail the likelihood of error even if inferencing procedures are not adequate (Kruglanski & Ajzen, 1983).

Taking into account these observations, our results reveal that:

a) Reasoning. Though judgement-making is presumed to be based on formal reasoning, our results show that most legal judgements (74.95%) rest on informal reasoning i.e., bias. The main source of bias was anchorage, which mediated more than half of the judgements (63.6%).
b) Cognitive saving. Whereas as anchorage was found to be an important cognitive saving strategy for judgement-making, information saliency and availability, and preconceptions were not. In short, the latter strategies require inferencing though this does not imply that they are not cost-saving strategies in other spheres of the judicial process.
c) Verdicts. As expected, given the origins of anchorage in judicial proceedings, which are linked to the prosecutions plea of guilt or to previous judgements sent to appeal courts, verdicts tend to be associated to a guilty outcome. In contrast, judges rely on preconceptions to reach a not guilty verdicts. Finally, information saliency and availability have no relation with the verdict reached.
d) Information processing. In information processing, anchorage induces judges to exclude neutral information and information in favour of the accused which increases the incidence of guilty verdicts. Thus, anchorage leads to "information-exclusion processes" whereby both versions of the evidence are not considered before reaching a judgement. Preconceptions were linked to "information-integration processes" since judges equally process the information either in favour or against the accused, giving greater priority to neutral reasoning. In other words, both versions of the evidence are integrated. In comparison, judgements mediated by information saliency and availability tend to generate more reasoning in favour of the accused i.e., "pro-accused processing", though this does not result in not guilty verdicts as would be expected.
e) Evidence. Anchorage enables a judge to arrive at decision without justifying it. Preconceptions, however, require a greater factual nexus for inferencing. As for bias derived from information saliency and availability the results were as expected i.e., related to the evidence.
f) Causal nexus. The reconstruction of events was less "causally guided" (both physically and temporally) in the decisions mediated by anchorage.

g) Ruling. The judgements associated to anchorage rested less on legal aspects (legal details, etc). As for the judgements based on the judge's preconceptions, these referred less to the law of precedence.

In conclusion, judicial decisions are based to a large extent on informal reasoning, which is indicative of bias, as opposed to expected formal reasoning in which information is correctly treated (see Kruglanski & Azjen, 1983 for a review and discussion). Given that one of the anomalous sources of informal reasoning is metacognitive deficit, Perkins (1989) suggests that the solution to counter these sources of bias is to raise the judges' awareness of possible sources of bias, in order to deal with metacognitive deficits in informal reasoning by ensuring greater objectivity in decision-making.

Table 10. Univariate Effects in the Dimension "Specific Cognitive Activity"

Variable	MS	F	p	eta^2	M_0	M_1
Amount of legal details	112.487	2.465	.117	.004	5.086	6.318
Attributed accused mental state	88.823	6.384	.012	.011	1.700	2.795
Attributed victim mental state	51.335	42.774	.000	.072	.236	1.068
Contextual incrustation	1.049	6.201	.013	.011	1.801	1.682
Contextual information	1449.536	17.508	.000	.031	5.621	10.045
Description of interactions	313.641	2.349	.126	.004	7.317	9.375
Idiosyncratic information	2.988	.720	.396	.001	.837	.636
Neutral statements	31659.356	16.181	.000	.028	22.300	42.977
Physical causal relations	1.572	.830	.363	.001	.737	.591
Pro-accused statements	48.332	.782	.377	.001	3.351	4.159
Reproduction of conversations	100.495	5.249	.022	.009	1.244	2.409
Statements against the accused	370.706	1.034	.310	.002	15.056	12.818
Temporal causal relations	161.872	1.190	.276	.002	7.317	8.795

Note: D.F. (1,553); M_0= mean of the judgements without preconceptions; M_1= mean of the judgements driven by preconceptions.

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