Received: 4 June 2020 | Revised: 27 August 2020 | Accepted: 26 September 2020

DOI: 10.1002/asi.24424

RESEARCH ARTICLE

JASIST WILEY

Resonance and the experience of relevance

Ian Ruthven

Department of Computer and Information Sciences, University of Strathclyde, Glasgow, UK

Correspondence
Ian Ruthven, Department of Computer and Information Sciences, University of Strathclyde, Glasgow, UK.
Email: ian.ruthven@strath.ac.uk

Funding information
University of Strathclyde

Abstract

In this article, I propose the concept of resonance as a useful one for describing what it means to experience relevance. Based on an extensive interdisciplinary review, I provide a novel framework that presents resonance as a spectrum of experience with a multitude of outcomes ranging from a sense of harmony and coherence to life transformation. I argue that resonance has different properties to the more traditional interpretation of relevance and provides a better system of explanation of what it means to experience relevance. I show how traditional approaches to relevance and resonance work in a complementary fashion and outline how resonance may present distinct new lines of research into relevance theory.

Relevance has stood as a dominant concept in Information Seeking and Retrieval research for decades (Barry & Schamber, 1998; Borlund, 2003; Froehlich, 1994; Hjørland, 2010; Mizzaro, 1997; Saracevic, 2016). It is the basis for measurement in nearly all aspects of Information Retrieval (IR), is fundamental to the test collection model of evaluation (Harman, 2011) and central to user studies of search behavior (Kelly, 2009). As Jansen and Rieh observed when proposing it as one of their theoretical constructs of information searching and retrieval, "*it is difficult to find a concept that has generated more discussion in or had more impact on the fields of information searching and information retrieval than has relevance*." (Jansen & Rieh, 2010). Yet, perennially, we encounter papers calling for its clarification or its abandonment as a central concept within Information Science.

In his most recent review of relevance, Saracevic, the leading scholar on the topic, said "*Relevance research became poor* [after the 1960s] *and remained so till this day*." (Saracevic, 2016). This sounds surprising given how much attention has been given to relevance by the IR community and how much has been invested in this research. However, Saracevic's point is that most relevance research has been on relevance assessments, and how we use them for evaluation, and far less on relevance itself. Due to the substantial efforts of the IR community into initiatives such as TREC we have learned much about what to do with relevance for evaluation but have learned far less about relevance itself and how we should investigate it (Ruthven, 2014).

Relevance has an intuitive appeal; it is an everyday concept. Saracevic claims that relevance is "*a 'y'know' notion*" (Saracevic, 2016), a concept that is broadly recognizable by researchers, practitioners and the lay participants that take part in our studies. This is its major strength. However, it is also relevance's major weakness: this "recognise it when we see it" approach that IR has generally taken to relevance has placed less effort into a systematic understanding of relevance and recent years has seen little progress in the conceptualization of relevance. This is worrying as umbrella terms such as relevance risk construct collapse if the elements of the construct—the various meanings used by the term—cannot be made coherent (Hirsch & Levin, 1999).

This article does not seek to redefine relevance. Rather, it introduces resonance as a useful explanatory concept for thinking about relevance and for helping to underpin relevance as meaningful concept within

Information Science. Specifically, I will argue that resonance is strong in helping us understand the *experience* of relevance, what it feels like to encounter relevant material. Here, I shall propose a model for resonance based on an extensive survey of the literature, explain how resonance relates to relevance and propose lines of investigation based on the use of resonance within Information Science.

1 | BACKGROUND

1.1 | Relevance

Relevance was the major concept in early Information Retrieval systems research. Simulating what may happen at a library reference desk, retrieval systems would select a set of documents that somehow matched a user's request. Those that were deemed as useful by the user were labeled as relevant and the systems' ability to retrieve these relevant documents was the basis for evaluating the retrieval system. However it became clear very quickly that relevance was a complex phenomenon or, as Cuadra and Katter put it, one that "*proved slippery, treacherous, and, to some, totally unrewarding*" (Cuadra & Katter, 1967).

There have been various attempts to unpack relevance, often starting from the observation that the label "relevance" seems to cover so many things. In his major review of relevance, Mizzaro points to Vickery in the late 1950s as distinguishing between topical relevance and "user" relevance, that is, between what a document is "about" and what a searcher actually wants (Mizzaro, 1997). This distinction has continued for decades with many authors trying to redefine relevance in terms of other properties that feel more user-centered and operationalizable such as utility (Mao et al., 2016) or pertinence (Harter, 1992). As is clear from Mizzaro's discussion, however, the language is often conceptually confused (Mizzaro, 1998) and no solid alternative to relevance has taken hold. Relevance as a primary concept has stuck and we may be stuck with it.

In his classic text from 1996, Saracevic proposed a characterization of relevance by which relevance was described as different relations rather than as properties of objects, for example, algorithmic relevance as the lowest level is "*the relation between a query and information objects (texts) in the file of a system*" whereas motivational relevance, the highest level, is the "*relation between the intents, goals, and motivations of a user, and texts retrieved by a system*...." (Saracevic, 1996).

That relevance can be measured differently depending on what relationship we are measuring is central to Mizzaro's review and to Borlund's analytical examination of the relevance literature a few years later (Borlund, 2003). Borlund conflates the higher levels of Saracevic's relevance classification with user-centered (subjective) relevance and lower levels with system-centred (objective) relevance, concluding that "*Many researchers perceive situational relevance as the most realistic type of user relevance*." (Borlund, 2003). That is, situational relevance, as a contextually rich description of a searcher's decision-making process, is the closest to describing what happens when a searcher assesses an object as relevant.

However, topicality and "aboutness" are hard to get away from. As Froehlich notes, "*The prototypical core for relevance judgments or the nuclear sense of relevance is topicality*." (Froehlich, 1994). This fits with many other studies that show topicality works on a form of necessary-but-not-sufficient relationship with relevance: topicality is not sufficient for an object to be assessed as relevant but it is necessary for it to be present before we start asking other questions of the object to decide on its situational relevance.

These other questions are often framed within Barry and Schamber's influential scheme of relevance criteria, the reasons people give for marking some objects as relevant (Barry & Schamber, 1998). These criteria are a list of object, personal and situational attributes which are used as the raw material for making the compound decision of "relevance." Importantly, these criteria been shown in study after study to hold as the basis for relevance decisions in diverse situations, suggesting that they form part of a universal language with which we can talk about relevance (Albassam & Ruthven, 2018; Tsai-Youn, 2018).

Since these landmark studies it is easy to track core debates around how we measure relevance, what behaviors correlates with relevance and so on from the origins of Information Science into the modern literature.

So why do we need a new paper on relevance? Partly, because what we are doing with the concept of search and retrieval has changed. The majority of what has been written on relevance has focused on the problem-solving approach to information retrieval: broadly put, we seek information to solve problems. This stance is nicely encapsulated in Hjørland and Sejer Christensen's definition of relevance: "*Something (A) is relevant to a task (T) if it increases the likelihood of accomplishing the goal (G), which is implied by T*" (Hjørland & Sejer Christensen, 2002). We see it also in Mizzaro's focus on problems and needs as information need is often treated as a surrogate for the problem for which information may be the solution (Mizzaro, 1997) and Borlund's strong focus on the "work task" that initiates the need for information (Borlund, 2003).

Since then we have seen information seeking take on a wider focus, encapsulating leisure search, personal information search, ecommerce search and other types of search that are more hedonic in nature and where the reasons for searching are less about solving problems but about reminiscence (Albassam & Ruthven, 2018), the experience of interacting with enjoyable information (Saarinen & Vakkari, 2013) or pleasurable and profound experiences (Kari & Hartel, 2007). But in these studies on non-work tasks, the concept of relevance sometimes barely appears. So, the question arises if the classical discussions of relevance are still fit for purpose when discussing these areas or do we need to expand our relevance vocabulary to properly describe the information choices made in these areas?

Another reason for looking again at relevance is what we have learned, particularly over the last decade, about the role of emotion in cognition. In a major review of the role of emotions within decision-making, Lerner et al. note that "*many psychological scientists now assume that emotions are, for better or worse, the dominant driver of most meaningful decisions in life*." (Lerner, Li, Valdesolo, & Kassam, 2015). We know from everyday experience and formal studies that emotion can interfere with cognition (Lench, Bench, & Davis, 2016), that sometimes emotional comfort is preferred to informational value (Brashers, 2001) and that the experience provided by environments, including information environments, are powerful determinants in how we act in those environments (Pullman & Gross, 2004). Relevance's traditional focus on the intellectual properties of relevance have not given the same consideration to the role of emotions in making relevance decisions and, despite some very good research into emotions, for example, (Arapakis, Jose, & Gray, 2008; Nahl & Bilal, 2007; Savolainen, 2014), it does not seem that the emotional side of relevance has been properly integrated into relevance theory.

Therefore, given the wider nature of relevance and the wider factors that may affect how we determine relevance, we may need new ways of understanding relevance. This article proposes resonance as having useful characteristics that make it suitable for this task.

1.2 | Resonance

Resonance has its origins in the Latin re-sonare, to re-sound or sound again. It was introduced to the English language in the 15th century[1] up to three centuries earlier than relevance.[2] It is a concept that reaches across disciplines and languages and its attractive conceptual properties has given rise to many new concepts, including aesthetic resonance, affective resonance, bodily resonance, brand resonance, carnal resonance, consumer resonance, cultural resonance, embodied resonance, emotional resonance, ethical resonance, frame resonance, historical resonance, institutional resonance, interpersonal resonance, material resonance, morphic resonance, motor resonance, norm resonance, political resonance, neural resonance, scheme resonance, semiotic resonance, spiritual resonance, value resonance, and others.

Several authors have noted that, like relevance, resonance is often used without definition (Giorgi, 2017; McDonnell, 2014) and resonance is inconsistently used as a property of an object, a relationship between objects or the effect of one object on another. However, resonance has given rise to powerful systems of explanation that are particularly strong on the physical and emotional sensations created by resonance.

In the rest of this section, I wish to sketch some major uses of resonance to indicate the ways in which it has been used by other discipline before presenting a novel analysis of the concept.

In disciplines dealing with physical systems, resonance describes an amplification process brought about when two similarly vibrating objects are brought into close proximity.[3] In music, the intensity of music is increased by resonance either though the similar vibration frequencies of musical instruments or through the voice apparatus. This is related to the lovely theory that resonance is why music is pleasurable and why it sends young children to sleep—because the instruments vibrate in a way that is sympathetic to our body's natural frequency (Harvey & Harrison, 2013).

Many areas of medical science and psychology are concerned with resonance. The amplification associated with resonance is believed to occur in the limbic system of our brains. The limbic system is a very old part of the brain that deals with low-level information processing, especially emotional processing, and is seen as core to the laying down of memories. Limbic Resonance is the proposal that the ability to share deep emotional states comes from the limbic system (Lewis, Amini, & Lannon, 2001) and that, in our earliest infancy, we synchronize our limbic system to that of those most closest to us. This includes synchronizing our emotions but also our physical reactions to emotion such as our respiration, blood and heart pressure. In other words, we learn how to react to emotions from our resonance with close kin.

Limbic Resonance is seen as the basis for empathy in humans and therefore socialization. Understanding others is a key evolutionary advantage and humans develop this ability very early in our lives. Between 3 and 6 months we develop what is referred to as motor

resonance in which the neurons in our brain simulate what is happening in someone else's brain when they interact with the world (Natale et al., 2014). For example, if we observe someone grasp an object then our brain, through motor resonance, simulates the neural patterns necessary to grasp that object: we replay that person's brain signals in our brain (Natale et al., 2014; Paulus, Hunnius, Vissers, & Bekkering, 2011). This lends itself to imitative learning by young infants to help them adjust to the world (Natale et al., 2014). A related phenomenon is neural resonance when we can "feel" what another person feels, for example, when we see someone trap their hand in a door then we "feel" their pain rather than simply recognize that they are in pain (Vaughn, Savjani, Cohen, & Eagleman, 2018). At higher psychological levels, there is a large body of research on the relationship between empathy and resonance, including in therapeutic situations where empathic resonance is often seen as the foundation for successful therapy (Decety & Ickes, 2009).

Within the marketing literature, the concept of brand resonance is particularly strong. This refers to the relationship a customer has with a product and the degree to which we, as a customer, believe we are compatible with the brand or believe we and the brand share the same values (Keller, 2012; Raut, Brito, & Pawar, 2020). Brand resonance is highly prized as it means a product has both reached an audience in terms of salience but also that the product has become meaningful to customers. Some brands become so dominant that they reach what Suarez refers to as "*Institutional Resonance*," in which brands such as Coke, Apple or Google becomes the "*...archetypal representation of a social institution*." (Suarez & Belk, 2017).

Resonance has also been used many other research disciplines, including literature, communication, religion, education, politics, and drama. The aim of this article is to evaluate whether, having been identified as being useful in these others domains, resonance can be useful in helping us expand our thinking about relevance in the wide variety of search situations in which we now engage and whether it can help us understand the experience of interacting with relevant information. The process is through analysis of the ways in which the concept has been used across a wide range of academic literature to produce a new model of resonance and then analyze the model against traditional understandings of relevance.

2 | METHODS

The approach followed was to gather a wide set of research material that mention the term resonance and then subject the documents to a process of thematic analysis. The approach followed is similar in spirit to concept analysis (Foley & Davis, 2017) except that synonyms were not used in order to retain a focus on the specific term resonance.

2.1 | Sources

The research material was obtained in two stages, one stage focused on the Information Science literature and the second on a general search of the wider literature. In both cases, the search covered at least a decade of material from first January 2008 to first January 2019. A decade was felt to be a reasonable timespan for analysis. The full search strategy is presented in Appendix.

1) *Information science literature*. Abstract searches were run on LISA and LISTA and full text searches on major Information Science conferences and journals. Full text searches were used to provide as comprehensive a coverage of the uses of resonance as possible. This search process resulted in 542 abstracts and full-text articles.

2) *General literature*. A search was run on Scopus across all subject areas containing the word "resonance" in the title, abstract or keywords from January 2008 to December 2018. This resulted in over 940,000 titles and abstracts of articles, book chapters, reviews and books. The search query was then iteratively edited to exclude, based on titles, uses of resonance that were electrical or physical uses of resonance. The final query left around 37,500 titles.

Duplicates were removed. Mistakes, instances of resonance as a proper noun and uses that related to functional magnetic resonance imaging, computational, sound-related or physical uses of resonance were removed. This was to retain a focus on uses of resonance that involve a human experience.

Non-English texts were included using either publisher translations or using Google's translation service. If the sense in which resonance was being used could not be ascertained from the English translation of the abstract, and no English full text was available, then the document was eliminated. Eleven French, 5 Spanish, 5 German, 3 Portuguese, and 1 Italian texts were included in the analysis.

Some documents only contained the search term within quotes either from research participants or from other papers rather than author's use of the term. These were retained as they may provide informative uses of the term resonance.

These filters led to a final set of 679 documents for analysis, 360 from the Information Science set and 319 from the Scopus set.

2.2 | Analysis

Most documents only contained one instance of resonance or its linguistic variants and where there were multiple instances of the term within the document, the same sense of the word was usually intended. Therefore, sentence became the unit of analysis for most of the literature, but document was the level of classification into theme. Where there was a full text available, all linguistic variants of resonance were analyzed. Where only a title and abstract were available—and the sense of resonance was clear from these—only these parts of the documents were analyzed.

Definitions of resonance were provided in only a small number of cases and more detailed discussions of these will be presented below. In most cases, resonance was not used to refer to a specific definition but rather used in an everyday sense. This meant that there was often a vagueness as to what was meant by the term. Where the sentence could not afford a definition, the surrounding text was considered to try to clarify meaning.

The sentences were then subject to a process of iterative analysis to establish the main senses in which resonance and its variants were used. The looseness around the term's use and the way that different disciplines use the term meant that initial coding was fragmented with many tentative codes which then required heavy use of cross-comparison to establish the final themes.

As the analysis progressed, it became apparent that even though the common sense of resonance as being some kind of similarity-based amplification underlay most uses of the term, some uses of resonance were more specific than others and some described a more powerful experience than others. What became clear was the various uses of resonance fell into one of three major themes labeled here as *agreement*, *arousal* and *action* that form a spectrum of resonance from simple similarity through to a force that leads to action. Due to the preconceptual and everyday nature of most uses of the term resonance, the boundaries between these themes are fuzzy and overlapping.

Nearly all the examined material treats resonance as a region on this spectrum but the region varies between texts. This article is the first to map out resonance as a *spectrum* of experience with qualitatively different regions, where different definitions and uses of resonance can be placed.

3 | THE RESONANCE SPECTRUM

In the sections below, I shall introduce the three regions of the Resonance Spectrum. In each case I shall present a table, derived from the literature, that summarizes the region according to three components: what are the preconditions for resonance in that region, what mechanisms facilitate resonance and what are the consequences of resonance. The preconditions express what authors believe is important for resonance to manifest, for example, in Table 1 receptiveness to a message is seen by many authors as an important pre-condition as one must be psychologically open to an idea for one to agree with it. The facilitating mechanisms are the ways in which resonance happens or can be facilitated, for example, metaphor is often a rhetorical device to link new messages to existing beliefs or attitudes and thereby facilitate resonance between them. The consequences are what authors have described as resulting from resonance, for example, a feeling of being aroused or a sense of excitement. The literatures are dealing with information in different forms: poetry, advertising, education, political messaging, etc. so these consequences are all consequences of experiencing information.

TABLE 1 Resonance as agreement

Preconditions	Facilitating mechanisms	Consequences
• Alertness or openness • Collectivity of experience or purpose • Points of identification • Receptiveness • Shared representations • Shared states of knowledge	• Alignments • Analogies • Attunement to another • Bridges and explanations • Correspondences • Creative associations • Emergent environment of mutual facilitation • Fit of form and function in communication • Metaphors • Parallels and repetitions • Personal discovery of similarity	• Activated memories and evocation, sense of echoes • Amplification of certain meanings or interpretations • Feelings that require explanation • "Felt" similarity with someone or something • Intensification or enrichment of experience • Sense of coherence • Sense of harmony • Sense of well-being • Recognition of that which was not previously seen as important • Reinforcement of beliefs

3.1 | Resonance as agreement

A major sense of resonance is to refer to agreement, Table 1. Here, resonance starts from a position of having an existing tendency towards a stance, belief, or information about the world. There is already some shared knowledge, perhaps some collective purpose and an alertness or receptiveness towards certain information. This is similar to how some authors have discussed relevance as arising from an predisposition to see some information as relevant (Wilson & Sperber, 2002).

Resonance implies there is a distance to be bridged between two similar but not identical entities (McDonnell, Bail, & Tavory, 2017). What facilitates agreement are ways that enable the detection of agreement such as metaphors, analogies, and explanations, or environments in which similar entities (such as people with similar experiences) can recognize similarity in each other. Many artistic uses of resonance are found here and the resonance of agreement can lead to a variety of felt experiences: activated memories, feelings of similarity or feelings that require some kind of explanation, an intensification of existing feelings, including justification or validation, or senses of coherence or harmony. A strong sense of evocative stimulation is a common reaction to resonance at this level. Resonance through agreement can lead to selective amplification of certain meanings or interpretations as resonance amplifies some "signals" over others. However, these meanings or interpretations are already somehow present: resonance amplifies them.

Often this agreement is with published scholarship, for example, "*This finding resonates with Saracevic's (1999) claim that LIS is technology driven*." (Milojević, Sugimoto, Yan, & Ding, 2011). This agreement is usually topical agreement but frequently has the implicit sense that resonance goes beyond simple agreement to agreement of a particular kind involving identification with the idea or experience, possibly a sense of recall of prior experience, and a recognition that the agreement is somehow significant to the person who is experiencing resonance.

3.2 | Resonance as arousal

The second major theme is what I refer to as "resonance as arousal," Table 2. The preconditions build on what goes before regarding a pre-disposition or receptiveness to some information but with a stronger focus on the attributes of the message as the facilitating mechanism: is it accessible, is it culturally appropriate, is there some existing familiarity with its content?

In the Background section, I briefly discussed brand resonance as the relationship between a product and customer. Brand resonance is closely related to the more general concept of frame resonance. Frames are ways that one group of people interpret or present reality for another group (Giorgi, 2017; Trumpy, 2016). They are commonly used in marketing, politics, and communication to abstract a certain area of life for presentation to an audience. In marketing a good example is someone like Martha Stewart who packages up a way of living that is resonant with a particular demographic who, sharing her aesthetic, admire her frame of how to organize celebrations, how to decorate one's house, how to plant a garden, etc. (Giorgi, 2017). Successful political movements are successful because they have ways of organizing their beliefs and aims into a frame that can be used appeal to like-minded people. This is a process of information organization and presentation: "*The framing process aims to make sense of the available information by focusing on certain pieces of information and encouraging people to interpret them in a particular way*." (Trumpy, 2016). Therefore, information is packaged in a way to encourage resonance.

The key here is existing similarity as "*Common ways of understanding the world, widely shared values, and recognizable norms or behavior legitimize certain frames, making them more natural, familiar, and appealing*." (Trumpy, 2016). In a major review of the concept of resonance in marketing theory Giorgi identified a number of themes in the way resonance is defined including "*the degree of the cultural object's alignment with the audience*," "*emotional harmony with recruit's emotional lives*," "*alignment between a movement's ideology and the beliefs of an adherent*," "*alignment with the target's values, beliefs, and ideas*," and "*congruence with the client's lives and experiences*" all of which argue to resonance as some kind of alignment or absorbing experience brought about by encountering something—a message, person, viewpoint, product—that is mediated by the frame in which the other (message, person, viewpoint, product) is presented (Giorgi, 2017). Frames are a way in which one party defines reality for another and thereby how they should think and behave.

Giorgi shows that both cognition and emotion can be used to promote resonance. Cognitive aspects of resonance are the perceived alignment with the beliefs and understandings of the audience whereas emotional resonance is a felt alignment with passions, desires, and aspirations (Giorgi, 2017). Familiarity is important as familiarity expresses what we have already experienced and accepted and so therefore familiarity aids quick acceptance of what is new. There is a sweet spot between what is already understood and what is novel, what

TABLE 2 Resonance as arousal

Preconditions	Facilitating mechanisms	Consequences
• Accessibility of message • Correlation of references and meanings • Credibility of frame and framer • Cultural appropriateness of message • Familiarity with content • Mood (attunement to certain sensibilities)	• Ability of object to transcend immediate boundaries • Active engagement with message or information • Frames • Evocative storytelling • Moderate novelty • Personal and specific references • Ritualization • Sensationalism	• Amplification of existing sensitivity or disposition • Awareness of self • Better response to others' needs • Creation of a new state where potential lies • Deeper feelings and emotions • Experience of being electrified • Feeling of new awakening • Frisson • Greater insight through, for example, empathy, reflection or new awareness of what is significant • Greater legacy of message • Greater sense of openness and responsiveness • Identification with a vicarious experience • Inspiration • Lasting appeal and emotional connection • More agreement with message • New feelings and insights • Physical sense of being enlivened • Stimulating agreement • Transformation, for example, of news into myth or experience into ritual • Transcendence

Giorgi calls "*moderate novelty*"—novelty embedded or associated with what is already familiar to aid its understanding and acceptance.

The frames created and their nature (are they personalized, do they tap into existing dispositions, are they part of wider rituals) seem to enhance the power of the message to go beyond agreement into being aroused or stimulated by the message. Our active engagement with the other person/message/information can also increase the chances of going beyond simple agreement, as can the nature of the object itself. I shall return to this last point later.

The consequences of resonance as arousal are many and varied. Resonance at this level has been seen to cause a heightening or deepening of emotions, for example, a frisson or lasting emotional connection, to new and greater insights, to new states such as transcendence and to greater agreement. Resonance can also be responsible for increased legacy or influence over time.

Many authors see resonance as a property that can be created. For example, resonance is one of Tracy and Hinrich's quality criteria for qualitative research, described as "*the extent to which a text meaningfully impacts an audience such that a reader can make connections between the themes or findings in the study at hand...*" (Tracy & Hinrichs, 2017) and is created by the way researchers describe their research.

In many of these outcomes, there is a physical sense of being altered by resonance and in some cases almost a psychical sense of being aroused. This sense of being aroused by information speaks to the experience of encountering relevant information: what it feels like to experience relevance.

3.3 | Resonance as action

The final theme views resonance as what happens when resonance from arousal leads to actions, Table 3. Mostly this is in the sense of actions performed by those who feel resonance but sometimes it is the sense of being acted upon.

There are fewer pre-conditions in the literature specific to this category and this expresses the general

TABLE 3 Resonance as action

Pre-conditions	Facilitating mechanisms	Consequences
• Plasticity for multiple interpretations—Potential for co-production of meaning and sense	• Ability of others to push message within networks • Active listening • Commonality of experience • Desire • Hyper-differentiation • Realization of possibility of action • Pleasure maximization • Sticky messages • Unexpected juxtapositions	• Becoming a standard or dominant approach • Citations, views, downloads, use and sales • Cult status • Endurance of influence • Feeling of divine revelation • Growth and change in understanding • Improved response from others • Increased acceptance of beliefs associated with the resonating one • Increased propagation of message by others • Increased cost associated to a product • Interacting systems of affect and being affected • Lasting sense of being affected • Mirroring of others • Mutually agreed beliefs • New engagement • New members or followers • Policy change • Positive representations by others • Public response • Remember/storing information for potential future use • Repricocity between partners • Reuse of information or objects • State legitimization of a set of beliefs • Social interaction • Transformation

tendency in the literature to see this level the most difficult to predict: why does one political movement, or advert, or slogan resonate in such a way to cause behavioral change while others do not? Here the discussions are mostly explanatory rather than predictive. One interesting proposal is that plasticity for multiple interpretations, that is the message or object permits a form of coproduction of meaning, while still retaining its sense of identity, is important.

It is harder to generalize the facilitating mechanisms here as the disciplines are so different but there must be some way to act and a desire to act can make action more likely. Increased choice (hyperdifferentiation), particularly personalized choice, is also more likely to lead to action. Resonance can also be facilitated by a form of attentive listening (Kane, 2012). Gill proposed that the form of a message has a major influence in particular whether the message aligned with SUCCES criteria (messages that are Simple, contain Unexpected elements, are Concrete, Credible, Emotional and in the form of Stories are most effective) (Grandon Gill, 2008). Crudely put, if people are already in the state where they are willing to act, they have a way to act and resonating mechanisms encourage action then action is more likely to occur.

As with previous areas on the spectrum, resonance brings about amplification which in this case appears as action. The willingness to act may have been brought about by arousal already caused but not all arousal will lead to action. There is a key distinction between what Rao labeled as hot and cool reactions (Rao, 2009). Hot reactions intensity emotions and signify emotional investment in a message or belief whereas cool reactions simply reflect emotional identification. As Rao presents it, hot reactions provide the trigger for action but cool reactions are often necessary for follow-through (Rao, 2009).

The consequences at this resonance region are better detailed in the literature and are extensive: (a) concrete

actions such as citing, buying, using or storing information or a defined change in some external entity such as government or organizational policy; (b) greater interaction such as new, increased or more engaged memberships, mirroring of others or greater alignment or beliefs—interaction itself being a classic sign of resonance—and greater transmission of ideas by others; (c) improved status, through other's actions of buying or using a product or object, leading to something becoming a dominant approach or product, achieving cult status or being able to charge a premium price for a product or service; (d) individual feelings of change such as feeling of divine revelation or transformation, which may involve the transformation of something ordinary into something newly significant and meaningful or the feeling that one is being acted upon by a higher power.

3.4 | Summary

What we have then is a spectrum of resonance that starts with simple agreement or recognition of similarity through to action. Resonance-as-action builds on resonance-as-arousal which builds on resonance-as-agreement. The shared similarity of agreement may be where resonance ends; often at this level there is little sense that resonance is being encouraged, rather it results from a predisposition to see a similarity and this observed similarity amplifies something already existing. Where resonance is encouraged at this level is through literary devices such as metaphor, analogy, and explanations and through bringing together of similar elements. At the arousal level, the facilitating mechanisms are often more active—this is where lies many of the disciplines, such as marketing, politics, leadership, and literature, where information is designed to have an effect - and the preconditions are more specific. The outcomes are also stronger and deeper.

Arousal is necessary for action but it is less obvious so far how arousal flips into action and I suspect the mechanisms identified in Table 3 have poor predictive power. The consequences though are real and can be profound. That resonance leads to action is clear by the many concrete outcomes described in the literature and if enough people are resonated into even simple actions like buying a product, then that product can achieve dominance and cultural significance.

Within Information Science most mentions of resonance are at the agreement and arousal level, almost all without any definition of what is meant by resonance. The small number of uses at the action level discuss citations and social media interactions as proxies for resonance.

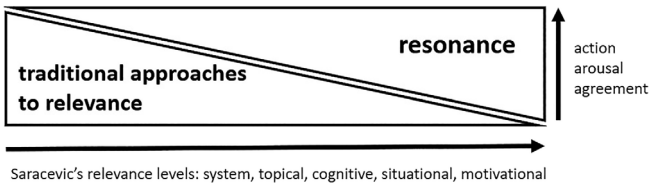

FIGURE 1 Relevance and resonance

The main author on resonance within Information Science is Gill who view resonance as a property that is distinct from relevance, seen as topical utility, that reflects "*...the ability of the research message to move through available channels to the client and, subsequently, to impact that client's mental models*" (Grandon Gill, 2009). Gill's model views resonance as operating as a series of biases, including cognitive and information biases, that assess inputs against existing schemas and beliefs, and which may or may not affect the individual's model of the world. Key to Gill's model is that we must appeal to the whole person, cognitive, emotional and visceral, to whom the message is being aimed to achieve resonance. Gill states that "*If a message does not quickly resonate with an individual recipient, the recipient is unlikely to put forth the effort required to become a subsequent sender.*" arguing toward the higher levels of resonance as action (Gill, 2008).

One of the few texts to propose that there may be more than one resonance at play is by Baden and David who "*...suggest a distinction between two possible meanings of resonance: Some ideas 'click' and are seamlessly appropriated in passing by a community, while others 'strike a chord' and raise a salient and emotional public debate.*" going onto suggest that these "*...constitute complementary, mutually exclusive phenomena.*" These two meanings seem to accord with resonance as agreement and resonance as action (in their case, public debate) (Baden & David, 2018).

Whether authors see resonance as a property of an object or as a relationship between an object and an individual, there can be a rich set of cognitive, affective and visceral outcomes happening as a result of resonance including senses of coherence, heightening or deepening of emotions, transcendence, alignment of beliefs and concrete actions. Where resonance is strongest, as evidenced by the tables above, is on these experiences that result from resonance. Whatever region we are at on the Resonance Spectrum, resonance can be seen as an experience brought about by an interaction with another object that is based on cognitive and/or emotional alignment with that object, one that amplifies our existing values, beliefs, desires and results in some kind of change from simple

recognition of similarity, through absorbing, possibly harmonious, experiences, to behavioral change.

This is not the traditional language of relevance: we do not often talk of relevance in this way, but resonance could lead us into such discussions as a way of better understanding relevance.

4 | DISCUSSION

In this discussion, I would like to consider some implications of introducing resonance into relevance theory: first, to consider how relevance and resonance relate to each other, second, how should we investigate resonance, then to consider how resonance encourages a new focus on information content. Parts of this discussion are speculative but I hope that they illustrate how studies of relevance can be enhanced by studies of resonance.

4.1 | How do relevance and resonance relate to each other?

Relevance has been most investigated in work settings. In such cases, there is an emphasis on explaining relevance decisions based on rational factors. This is not to say that relevance is objective as even in scenarios where relevance is tightly controlled there are significant variations in how people assign relevance decisions, for example, (Voorhees, 2000); however, many studies also show that people agree on the relevance of some documents more often than on others. Therefore, even if we cannot always say that the relevance of an object is objectively true or false, we can in many situations talk about better or worse selections of relevant information. In these situations, such as selecting references for academic papers or in search domains such as legal searches, our relevance judgments are open to other's scrutiny: they can assess our decisions on relevance and make judgments, including on our competence, based on these relevance outcomes. In an major work on relevance, Hjørland argued that relevance works at a collective level, that disciplines create knowledge bases that lead to judgments of relevance and that relevance is, to a degree, socially constructed (Hjørland, 2010). Several of the preconditions for resonance speak to this sense of being conditioned to certain messages by our environments and several outcomes from resonance are ones that lead to higher acceptance and use within social and professional settings.

Even in non-work tasks, such as finding a mortgage or health searches, we can say that some information choices are better than others. This is radically different from other situations in which we search. Searches for music, art, or fiction are not explainable in the same ways as searches for patents, legal documents, or medical reports. These choices are explainable but the explanations are not purely cognitive ones, more often they involve emotional or aesthetic components. In such situations, we respond in different ways to objects and our subjective responses lead to relevance decisions. However, our relevance language is impoverished when we talk about the non-cognitive aspects of relevance compared to the cognitive ones.

I am not suggesting that resonance replaces relevance but rather there is a space of relevance decision-making where (more or less) objective and intellectual criteria dominate and this includes many work situations where traditional approaches to relevance have been developed. There are other spaces, however, where both subjective and nonintellectual criteria are more influential and this is where resonance offers a different perspective. The latter category does include some work tasks as I believe the key difference is choice: when we have a large degree of choice, for example, in leisure activities, in fiction searches, in commerce, in choosing the focus of our next research project, and therefore increased opportunity for subjectivity to play a role in relevance decisions, resonance is the critical factor in determining what we choose as relevant from the variety of options before us. This is supported by Gill's proposition: "*Once a message meets the criteria of rigor and relevance, it may still fail to inform a client if it lacks resonance*" (Grandon Gill, 2008).

I visualize the relation between relevance and resonance as something like Figure 1.

At the extreme left-hand side, we have tasks in which there is little subjectivity in determining relevance and where cognitive factors such as topicality are most important. This is broadly where lies Saracevic's system and topical relevance. Examples include what Byström and Järvelin refer to as Automatic Information Processing Tasks (Byström & Järvelin, 1995), for example, finding all documents containing a key phrase. As we move along towards the middle, more subjectivity appears, coming from different states of knowledge, beliefs, motives, preferences, emotions, etc. and resonance—our experience of interacting with the information—becomes more important in determining what is assessed as relevant. In this middle section cognition and emotion are both important. As we reach the right-hand side we move into where Saracevic's motivational or affective relevance level lies, then emotional responses become more important. At the very right-hand side, we have situations where pure emotional response is most likely to be the dominant factor, for example, in cases of pleasure-driven searches. Therefore, at different relevance levels I

propose that our reactions to retrieved material has either little influence on relevance (left-hand side, system/topical relevance) or resonance is a dominant factor in determining relevance (right-hand side, affective relevance).

The Resonance Spectrum works along another dimension: at the extreme left-hand side, resonance is not important in determining relevance as, regardless of how resonant a document is, its relevance is established according to objective criteria. As we move towards the right-hand side, resonance does matter in determining relevance: documents that only result in agreement are less likely to be assessed as relevant than those at the action level. Documents at higher resonance levels are the ones most likely to make us feel a resonant connection, grab our attention and result in a resonance-based action such as marking a document as relevant, buying an item, watching a video, etc. Going further into information use, I propose that the more resonance there is with an object, the more likely that object is to be used and feature more strongly in the task for which information is being sought.

4.2 | How should we investigate resonance?

Resonance can be investigated using similar methods as relevance, but with a different focus, however the legacy of search and retrieval as a problem-solving activity may have led us into particular methods and resonance may open up the opportunity to explore new methods that have a focus on embodied reactions to information in its various forms (Keilty & Leazer, 2018).

A focus on resonance could take us into new directions for investigating relevance and its manifestations. For example, Barry and Schamber's relevance criteria is strong on intellectual components but is light on non-intellectual criteria, perhaps due to the work-related nature of the underlying data (Barry & Schamber, 1998). Even newer studies on relevance criteria in leisure settings, for example, (Albassam & Ruthven, 2018), which work with these original schemes also seem to understate the non-cognitive aspects of search whereas studies that take a more open approach detect more criteria that are about reactions to the material with which participants are engaging (Tsai-Youn, 2018).

Perhaps, then we could enrich our relevance vocabulary from well-validated relevance criteria such as topicality, tangibility, verifiability, etc. to consider resonance criteria, for example, inspiration, compelling narratives, stimulating examples, frisson, vicarious pleasure, etc. that may be what tips the "agreement," or simply identifying material as potentially relevant, to "arousal" leading to "action" of determining that something is relevant.

Resonance, with a stronger focus on experience, may also take us further into how relevance made us feel: do we get a sense of urgency or excitement, do we get an a-ha moment or a heart-stopping moment of transcendence? Maybe resonance is a better bridge to view the transition from identification of relevant material to use of that material: does the associated feelings we experience from reading information affect what we then do with it? For example, several authors have recently discussed meaning in the sense of value or purpose that we attach to our lives. Gorichanz discusses personally meaningful activities, activities that provide a sense of value or worth to a life, including the reading of scripture, portraiture and ultramarathon running (Gorichanaz, 2019). Ruthven describes meaning-making is a psychological process of discovery undertaken to try to re-establish a sense of value and purpose within an individual's life in response to a significant life change (Ruthven, 2019). Mekler and Hornbæk present resonance as one of the five components of a framework to describe the experience of meaning, describing resonance as "*a pronounced feeling of 'rightness' that emerges spontaneously in response to one's ongoing experience connecting with one's self in some way*" and posit that the lack of resonance is associated with "a feeling of '*wrongness*'" and anxiety (Mekler & Hornbæk, 2019). In these areas, information can have profound effects on how we live our lives and it may be that resonance is a key factor in how we react to and use such information.

It may also be a concept that helps balance the attention of information seeking towards affective and visceral components (Keilty & Leazer, 2018). This may involve investigative techniques that focus less on our conscious responses and more on unconscious responses, including approaches that study the effects of information on the activation of the sympathetic nervous system, including pupil dilation or skin conduction responses (e.g., Montagrin & Sander, 2016).

Resonance, like relevance, is only useful if it helps us explain something about interactions with information. Resonance may be more useful than relevance at explaining the experience of encountering relevant material and explaining why some relevant material is treated differently than other relevant material in its use.

Resonance may also connect us with different literatures than relevance, including areas of information creation and presentation such as marketing, media and communication. Resonance could be a novel link with work in neuropsychology to help us understand how resonance happens and therefore create a theory of resonance that flows from cellular activity to higher-level

decision-making. Some literatures treat resonance as an adaptive response, for example, the studies of limbic and emotional resonance, suggesting that we have evolved to be able to resonate emotionally with each other. This could lead into interesting questions of whether resonance is a way of forcing attention onto certain types of information, that is, that resonance as an experience is a way of directing us to certain stimuli that are of benefit. It may also be, if there are evolutionary properties to resonance, that some people are more sensitive to these stimuli than others and are better are relevance/resonance decisions than others.

4.3 | How does resonance relate to content?

Resonance may also encourage us to ask different questions about how we represent and retrieve information objects. Saracevic said "*There is ALWAYS, repeat ALWAYS, a 'to,' associated with relevance... Nothing can be relevant if there is no 'to' involved*." (Saracevic, 2016). That is, relevance is a contextual relationship between a person and an object and does not exist as an independent property of that object. This is very true; however, we also know that we have different types of relationships with some objects than others. For example, some songs are often reinterpreted by other artists, some books become classics that are read and re-read leading to cult status, some museum objects seem to speak across time and cultures: some objects lend themselves to resonance more than others. Therefore, even if relevance/resonance always has a 'to,' some objects seem to have some innate features that lend themselves to resonance.

In cultural studies, the emphasis is less on the frames that facilitate resonance and more on the objects themselves (McDonnell et al., 2017). McDonnell et al. see resonance "*as an experience emerging when affective and cognitive work provides actors with novel ways to puzzle out, or 'solve,' practical situations*," so resonance emerges due to interaction between objects and people. They also note that "*A large literature indicates social movement organizations inspire people to participate in ... forms of collective behavior by deploying cultural objects that resonate with broad public understandings ...*" suggesting that some objects are a better fit to contemporary concerns than others and can stand symbolically for those concerns.

Dimock defines resonance as a text's ability to reverberate across generations noting that what enables this is a text's flexibility to allow itself to be appropriated and refashioned by new generations (Dimock, 1997). This is similar to the "*plasticity*" mentioned in Table 3.1 suggesting that some objects display this property more than others.

Rosa, writing extensively on resonance as interaction with the world—being affected by and affecting the world—talks eloquently about the relationship between artistic forms and resonance: "*What is specific to art is that, beyond the experience of pure resonance, it is also capable of recreating, giving expression to, and thus making palpable the whole spectrum of historically and culturally possible relationships to the world. What drives modern subjects to visit museums and movie theatres, concert halls and opera houses, to read novels, poems and plays...is that fact that these activities allow them, at least at a pathic level, to test out and rehearse in a playful and exploratory way widely different modes of relating to the world.... Aesthetic resonance is thus an experimental field for adaptively transforming different models of relating to the world*." (Rosa, 2019).

A focus on resonance could encourage us to ask questions about why some objects lend themselves to different experiences than others and what this means for relevance decisions. This has much in spirit with Latham's explorations of what it means to experience a document (Latham, 2014) and Gorichanaz's examination of information experience (Gorichanaz, 2019). Although neither of them use the term resonance explicitly there is a clear connection to the outcomes presented above.

If some objects are more capable of being in a resonant relationship with people than others, then understanding why this is the case could lead to new ways of describing and retrieving those objects to prioritize the retrieval of such material. It may also lead to new search systems: currently, search interfaces ask us what we wish to know and use presentation techniques that display information in a way that makes it easier to assess whether an object is likely to be relevant to us. By doing the same thing with resonance, we may be able to create new search interfaces that help us express how we wish to feel as a result of obtaining information and present search results that help us see which objects are most likely to resonate with us.

5 | LIMITATIONS

This work has primarily focused on the English word resonance. Some of the sources used were translated versions of works in languages other than English. There were insufficient instances to properly test the degree to which resonance as described here has similar meanings and connotations in other languages. However, my general sense is that these translations did not contain significant differences from the meanings present in the

English texts and the variation between disciplines seemed larger than the variation between languages. I asked colleagues who speak several languages and they confirm that resonance has counterparts in many languages with European origins, at least for Afrikaans, Croatian, Danish, French, German, Italian, Portuguese, Spanish, Swedish, and Norwegian. For non-European languages, the situation is different: in Hindi there appears to be no specific word for resonance but the concept of amplification through similarity is understood. In Korean there is a concept for resonance as amplification, but interpersonal harmony a different concept. So, although broadly understood by everyone I spoke to, there is fruitful work to be done in defining how the Resonance Spectrum translates into other languages and what connotations resonance has in those languages.

Restricting the search strategy to works with "resonance" in the title, abstract or keywords for the Scopus search was necessary due to the high number of search results. However, this may have missed some texts that contain useful discussions of resonance. Given the number of documents used to develop the framework, I hope it is reasonably robust as is stands but it can be developed further with new works as they emerge or are discovered using other search strategies. The literature search covered a wide range of disciplines but a reliance primarily on Scopus may mean that some areas and types of documents are under-represented in the framework.

This article presents resonance as one dimension of relevance; there will certainly be others. The concept of resonance itself is still amorphous in places because in some disciplines it is still emergent: in physical systems research, the idea of resonance as amplification is strong and well-defined, in other areas where resonance is a metaphor, the concept is often still loose and everyday in its use. In most works considered here, resonance is a metaphor but many also speak to a physical reaction created by resonance so there is an interesting, but yet unexplored, space where resonance as a real physical phenomenon may overlap with resonance as a metaphor to describe human experience.

6 | CONCLUSION

This article asks what does it feel like to encounter relevant information—what is our experience of relevance? It makes the theoretical proposal that resonance, widely used in other disciplines, could be a useful way of investigating those areas of relevance that are more subjective and emotionally influenced. Through an extensive interdisciplinary review, I argue that resonance, as an experience, is a spectrum from simple agreement to various kinds of action. I show how resonance can fit theoretically with established notions of relevance and that it also offers fruitful new directions for investigating relevance.

ACKNOWLEDGMENTS

I am very grateful to the participants of the second Workshop on Evaluation of Personalised Information Retrieval for giving me the opportunity to develop some of the ideas presented in this article and their encouragement. Thanks also go to my colleagues at the Strathclyde ischool for their constructive feedback, especially to Dr David McMenemy who is a constant source of stimulating reading material and Dr Perla Innocenti for her support of this work. I am grateful to Google Scholar and Google's translation services and to the University of Strathclyde Library for providing access to so many resources during this research. I am especially grateful to the three anonymous reviewers for their very insightful and thought-provoking comments and suggestions which have improved the manuscript significantly.

ORCID

Ian Ruthven https://orcid.org/0000-0001-6669-5376

ENDNOTES

[1] https://www.merriam-webster.com/dictionary/resonance.

[2] https://www.merriam-webster.com/dictionary/relevance.

[3] https://www.britannica.com/science/resonance-vibration.

REFERENCES

Albassam, S. A. A., & Ruthven, I. (2018). Users' relevance criteria for video in leisure contexts. *Journal of Documentation*, *74*(1), 62–79.

Arapakis, I., Jose, J. M., & Gray, P. D. (2008). *Affective feedback: An investigation into the role of emotions in the information seeking process*. Paper presented at the Proceedings of the 31st annual international ACM SIGIR conference on research and development in information retrieval.

Baden, C., & David, Y. (2018). On resonance: A study of culture-dependent reinterpretations of extremist violence in Israeli media discourse. *Media, Culture & Society*, *40*(4), 514–534.

Barry, C. L., & Schamber, L. (1998). Users' criteria for relevance evaluation: A cross-situational comparison. *Information Processing & Management*, *34*(2–3), 219–236.

Borlund, P. (2003). The concept of relevance in IR. *Journal of the American Society for Information Science and Technology*, *54* (10), 913–925.

Brashers, D. E. (2001). Communication and uncertainty management. *Journal of Communication*, *51*(3), 477–497.

Byström, K., & Järvelin, K. (1995). Task complexity affects information seeking and use. *Information Processing and Management*, *31*(2), 191–213.

Cuadra, C. A., & Katter, R. V. (1967). Opening the black box of 'Relevance'. *Journal of Documentation*, *23*(4), 291–303.

Decety, J. E., & Ickes, W. E. (2009). *The social neuroscience of empathy*, Cambridge, MA: MIT Press.

Dimock, W. C. (1997). A theory of resonance. *PMLA*, *112*(5), 1060–1071.

Foley, A. S., & Davis, A. H. (2017). A guide to concept analysis. *Clinical Nurse Specialist*, *31*(2), 70–73.

Froehlich, T. J. (1994). Relevance reconsidered—Towards an agenda for the 21st century: Introduction to special topic issue on relevance research. *Journal of the American Society for Information Science*, *45*(3), 124–134.

Gill, T. G. (2008). Resonance within the client-to-client system: Criticality, cascades, and tipping points. *Informing Science*, *11*, 311–348.

Giorgi, S. (2017). The mind and heart of resonance: The role of cognition and emotions in frame effectiveness. *Journal of Management Studies*, *54*(5), 711–738. https://doi.org/10.1111/joms.12278

Gorichanaz, T. (2019). Information experience in personally meaningful activities. *Journal of the Association for Information Science and Technology*, *70*(12), 1302–1310.

Grandon Gill, T. (2008). The single client resonance model: Beyond rigor and relevance. *Informing Science*, *11*, 281–310.

Grandon Gill, T. (2009). Informing resonance: Beyond rigor and relevance. *Foundations of Informing Science*, *1999–2008*, 239.

Harman, D. (2011). *Information retrieval evaluation*, San Rafael, California: Morgan & Claypool Publishers.

Harter, S. P. (1992). Psychological relevance and information science. *Journal of the American Society for Information Science*, *43*(9), 602–615.

Harvey, E. D., & Harrison, T. M. (2013). Embodied resonances: Early modern science and tropologies of connections in Donne's anniversaries. *ELH*, *80*(4), 981–1008.

Hirsch, P. M., & Levin, D. Z. (1999). Umbrella advocates versus validity police: A life-cycle model. *Organization Science*, *10*(2), 199–212.

Hjørland, B. (2010). The foundation of the concept of relevance. *Journal of the American Society for Information Science and Technology*, *61*(2), 217–237.

Hjørland, B., & Christensen, F. S. (2002). Work tasks and socio-cognitive relevance: A specific example. *Journal of the American Society for Information Science and Technology*, *53*(11), 960–965.

Jansen, B. J., & Rieh, S. Y. (2010). The seventeen theoretical constructs of information searching and information retrieval. *Journal of the American Society for Information Science and Technology*, *61*(8), 1517–1534.

Kane, B. (2012). Jean-Luc Nancy and the listening subject. *Contemporary Music Review*, *31*(5–6), 439–447.

Kari, J., & Hartel, J. (2007). Information and higher things in life: Addressing the pleasurable and the profound in information science. *Journal of the American Society for Information Science and Technology*, *58*(8), 1131–1147.

Keilty, P., & Leazer, G. (2018). Feeling documents: Toward a phenomenology of information seeking. *Journal of Documentation*, *74*(3), 462–489.

Keller, K. L. (2012). Understanding the richness of brand relationships: Research dialogue on brands as intentional agents. *Journal of Consumer Psychology*, *22*(2), 186–190.

Kelly, D. (2009). Methods for evaluating interactive information retrieval systems with users. *Foundations and Trends in Information Retrieval*, *3*(1–2), 1–224.

Latham, K. F. (2014). Experiencing documents. *Journal of Documentation*, *70*(4), 544–561.

Lench, H. C., Bench, S. W., & Davis, E. L. (2016). Distraction from emotional information reduces biased judgements. *Cognition and Emotion*, *30*(4), 638–653.

Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. *Annual Review of Psychology*, *66*(1), 799–823.

Lewis, T., Amini, F., & Lannon, R. (2001). *A general theory of love*, New York City: Vintage.

Mao, J., Liu, Y., Zhou, K., Nie, J.-Y., Song, J., Zhang, M., ... Luo, H. (2016). *When does relevance mean usefulness and user satisfaction in web search?* Paper presented at the Proceedings of the 39th International ACM SIGIR conference on Research and Development in Information Retrieval, Pisa, Italy.

McDonnell, T. E. (2014). Drawing out culture: Productive methods to measure cognition and resonance. *Theory and Society*, *43*(3), 247–274.

McDonnell, T. E., Bail, C. A., & Tavory, I. (2017). A theory of resonance. *Sociological Theory*, *35*(1), 1–14.

Mekler, E. D., & Hornbæk, K. (2019). *A framework for the experience of meaning in human-computer interaction*. Paper presented at the Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems.

Milojević, S., Sugimoto, C. R., Yan, E., & Ding, Y. (2011). The cognitive structure of library and information science: Analysis of article title words. *Journal of the American Society for Information Science and Technology*, *62*(10), 1933–1953.

Mizzaro, S. (1997). Relevance: The whole history. *Journal of the American Society for Information Science*, *48*(9), 810–832.

Mizzaro, S. (1998). How many relevances in information retrieval? *Interacting with Computers*, *10*(3), 303–320.

Montagrin, A., & Sander, D. (2016). Emotional memory: From affective relevance to arousal. *Behavioral and Brain Sciences*, *39*, e216.

Nahl, D., & Bilal, D. (2007). *Information and emotion: The emergent affective paradigm in information behavior research and theory*, Medford, NJ: Information Today, Inc.

Natale, E., Senna, I., Bolognini, N., Quadrelli, E., Addabbo, M., Macchi Cassia, V., & Turati, C. (2014). Predicting others' intention involves motor resonance: EMG evidence from 6- and 9-month-old infants. *Developmental Cognitive Neuroscience*, *7*, 23–29.

Paulus, M., Hunnius, S., Vissers, M., & Bekkering, H. (2011). Bridging the gap between the other and me: The functional role of motor resonance and action effects in infants' imitation. *Developmental Science*, *14*(4), 901–910.

Pullman, M. E., & Gross, M. A. (2004). Ability of experience design elements to elicit emotions and loyalty behaviors. *Decision Sciences*, *35*(3), 551–578.

Rao, H. (2009). *Market rebels: How activists make or break radical innovations*, Princeton, NJ: Princeton University Press.

Raut, U. R., Brito, P. Q., & Pawar, P. A. (2020). Analysis of brand resonance measures to access, dimensionality, reliability and validity. *Global Business Review*, *21*(1), 162–175.

Rosa, H. (2019). *Resonance: A sociology of our relationship to the world*, Princeton, NJ: John Wiley & Sons.

Ruthven, I. (2014). Relevance behaviour in TREC. *Journal of Documentation*, *70*(6), 1098–1117.

Ruthven, I. (2019). *Making meaning: A focus for information interactions research*. Paper presented at the proceedings of the 2019 conference on human information interaction and retrieval.

Saarinen, K., & Vakkari, P. (2013). A sign of a good book: Readers' methods of accessing fiction in the public library. *Journal of Documentation*, *69*(5), 736–754.

Saracevic, T. (1996). *Relevance reconsidered*. Paper presented at the Proceedings of the second conference on conceptions of library and information science (CoLIS 2), Copenhagen.

Saracevic, T. (2016). The notion of relevance in information science: Everybody knows what relevance is. But, what is it really? *Synthesis Lectures on Information Concepts, Retrieval, and Services*, *8*(3), 1–109.

Savolainen, R. (2014). Emotions as motivators for information seeking: A conceptual analysis. *Library & Information Science Research*, *36*(1), 59–65.

Suarez, M., & Belk, R. (2017). Cultural resonance of global brands in Brazilian social movements. *International Marketing Review*, *34*(4), 480–497.

Tracy, S. J., & Hinrichs, M. M. (2017). Big tent criteria for qualitative quality. *The International Encyclopedia of Communication Research Methods*, 1–10.

Trumpy, A. J. (2016). 'I hate it, but it still sounds good': Collective identity and the evaluation of oppositional frame resonance. *Social Movement Studies*, *15*(2), 164–179.

Tsai-Youn, H. (2018). A study on the relevance criteria for journalistic images. *Journal of Library and Information Science*, *44*(2), 4.

Vaughn, D. A., Savjani, R. R., Cohen, M. S., & Eagleman, D. M. (2018). Empathic neural responses predict group allegiance. *Frontiers in Human Neuroscience*, *12*, 302

Voorhees, E. M. (2000). Variations in relevance judgments and the measurement of retrieval effectiveness. *Information Processing & Management*, *36*(5), 697–716.

Wilson, D., & Sperber, D. (2002). Relevance Theory. G. Ward, L. Horn (eds.), *Handbook of Pragmatics* (pp. 607–632). Hoboken, New Jersey: Blackwell.

How to cite this article: Ruthven I. Resonance and the experience of relevance. *J Assoc Inf Sci Technol*. 2020;1–16. https://doi.org/10.1002/asi.24424

APPENDIX A.

TABLE A1 Search strategy

Source	Search keys/date ranges/notes	Documents/ abstracts obtained
ASIS&T Annual Meeting	**Search key**: *resona** **Date range**: first January 2008 to first January 2019	43 documents
IPM	**Search keys**: *resonance*, *resonant*, *resonate*, *resonates* and *resonating* **Date range**: first January 2008 to first January 2019 **Notes**: IPM's archive does not allow wildcard searching	15 documents
Information research	**Search key**: *resonance*, *resonant*, *resonate*, *resonates* and *resonating* **Date range**: first January 1995 to first April 2019 **Notes**: Information Research's search facility does not allow wildcard or date-range searching so all articles, except book reviews, are included and the search was across all issues including special supplements (including several years' of the Information Seeking in Context and Conceptions of Library and Information Science conference proceedings).	50 documents
JDoC	**Search key**: *resona** **Date range**: first January 2008 to first January 2019 **Notes**: Only research articles were searched	53 documents
JASIST	**Search key**: *resona** **Date range**: first January 2008 to first January 2019 **Notes**: All article content was searched	98 documents
LISA/LISTA	**Search key**: *resona** **Date range**: first January 2008 to first January 2019 **Notes**: Only abstracts for articles in scholarly journals were considered	146/137 abstracts
SCOPUS	TITLE-ABS-KEY ((*resonance*) AND NOT (*magnet**) AND NOT (*plasma*) AND NOT (*electric**) AND NOT (*fmri*)) AND (LIMIT-TO (PUBYEAR, *2018*) OR LIMIT-TO (PUBYEAR, *2017*) OR LIMIT-TO (PUBYEAR, *2016*) OR LIMIT-TO (PUBYEAR, *2015*) OR LIMIT-TO (PUBYEAR, *2014*) OR LIMIT-TO (PUBYEAR, *2013*) OR LIMIT-TO (PUBYEAR, *2012*) OR LIMIT-TO (PUBYEAR, *2011*) OR LIMIT-TO (PUBYEAR, *2010*) OR LIMIT-TO (PUBYEAR, *2009*) OR LIMIT-TO (PUBYEAR, *2008*)) AND (EXCLUDE (SUBJAREA, "*PHYS*") OR EXCLUDE (SUBJAREA, "*ENGI*") OR EXCLUDE (SUBJAREA, "*MATE*") OR EXCLUDE (SUBJAREA, "*MATH*")) AND (LIMIT-TO (DOCTYPE, "*ar*") OR LIMIT-TO (DOCTYPE, "*cp*") OR LIMIT-TO (DOCTYPE, "*re*") OR LIMIT-TO (DOCTYPE, "*ch*") OR LIMIT-TO (DOCTYPE, "*bk*") OR LIMIT-TO (DOCTYPE, "*sh*"))	37,566 titles and abstracts