Shape of the ASA: Similarity Relationships Among the Society's Technical Areas

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The shape of the Acoustical Society of America (ASA) has grown, from its early conception toward decentralization of control over the functions of the Society to 13 separate technical areas (see **Table 1**). These technical areas, which are in charge of constructing the biannual conference program, have evolved over the years into constituencies with fairly distinct cultures of practice.

The ASA meetings draw members from different disciplines but with a common interest in various aspects of acoustics. This, after all, is why there is one society for all things acoustic. As organizers of the Fall 2014 ASA meeting in Indianapolis, we were tasked with placing the 13 areas in different rooms of the conference venue. Beyond finding space for each area, there was the additional challenge that members generally attend sessions in more than one technical area.

This logistical challenge actually presents a larger intellectual puzzle. How do these different technical areas coexist in the same society? In one room, one can find papers on tongue motor control in speakers of poorly documented languages and in the next room, talks on the acoustics of ship propellers.

Such conceptual cohesion problems are very common in cognitive psychology, and their structures are commonly encountered in various experimental paradigms. Dating from the 1950s, the concept of a psychological space inhabited by

Table 1. *Counts of members' primary and secondary interests in the 13 technical areas of the Acoustical Society of America*

	AA	EA	MA	N	PA	PP	SA	SC	UA	BA	AB	AO	SP	Total
AA		72	90	191	11	33	27	8	4	1	1		15	453
EA	167		34	170	145	20	109	4	62	43	4	2	70	830
MA	180	41		9	32	61	15	45	12	6	5	1	32	439
N	389	110	11		41	78	83	12	15	5	29	2	30	805
PA	23	125	51	43		14	30	24	57	125	1	2	40	535
PP	52	26	65	70	10		4	547	1	16	57	1	46	895
SA	64	105	30	105	77	7		1	39	14	2	1	25	470
SC	35	14	32	8	3	363	2		1	4	12		77	551
UA	2	46	4	11	78	5	45	2		12	123	130	95	553
BA	1	18	7	6	59	29	7	22	9		3	1	16	178
AB	3	2	3	7	3	69	3	16	49	7		19	11	192
AO		2	1		7			1	245	3	44		9	312
SP	35	88	58	22	100	103	34	207	191	43	27	5		913
Total	951	649	386	642	566	782	359	889	685	279	308	164	466	7,126

Columns are primary interests and rows are secondary interests. AA, architectural acoustics; AB, animal bioacoustics; AO, acoustical oceanography; BA, biomedical acoustics; EA, engineering acoustics; MA, musical acoustics; N, noise; PA, physical acoustics; PP, psychological and physiological acoustics; SA, structural acoustics and vibration; SC, speech communication; SP, signal processing; UA, underwater acoustics.

categories with various distances from one another was popularized, most notably by Shepard (1957), and has been utilized in a large body of subsequent research. This literature has afforded the mathematical operations of multidimensional scaling (MDS), developed by Togerson (1952) and others. MDS takes the measures of association between individual categories and distills them into a low-dimensional representation of the space inhabited by the categories, with their relative locations within this lower dimension space (Kruskal and Wish, 1978). (See Hout et al. [2013] for an overview of this technique and its applications.)

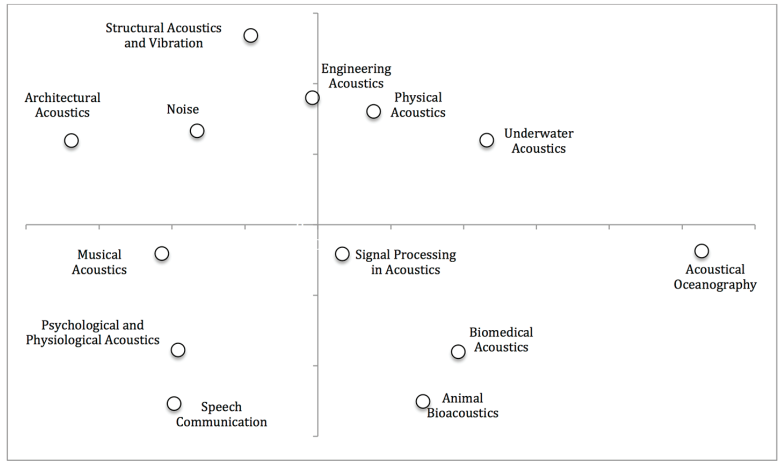

Figure 1. Results of the multidimensional scaling (MDS) analysis on members' primary and secondary interests in the 13 technical areas of the Acoustical Society of America. Data are from membership records from Fall 2014.

This was exactly what we needed to situate the technical areas in the conference venue, projecting the relationships between the 13 technical areas onto the (at most) 3 dimensions of the hotel space.

As input, we took ASA membership information concerning the primary and secondary areas of interest of 7,126 members, summed up in **Table 1**. Members choosing primary and secondary areas of interest indicated a proximity of the two areas.

The counts were submitted to an MDS analysis using the ALSCAL scaling algorithm (Takane et al., 1977) in SPSS. ALSCAL calculates the optimal distances between categories in an *n*-dimensional stimulus space by minimizing a stress value ("Kruskal's S-Stress"). The stress value is used to choose the optimal number of dimensions where any added dimension does not significantly improve the fit.

For our analysis, this process conveniently yielded two dimensions, shown in **Figure 1**. In the resulting target-shaped space, similar technical areas are located close to one another and dissimilar technical areas are further apart. Around the perimeter is a circular progression running (starting at ***bottom left***) from *Speech Communication* to *Psychological and Physiological Acoustics* to *Musical Acoustics* to *Architectural Acoustics* and *Noise* to *Structural Vibration* and *Engineering Acoustics* to *Physical Acoustics* to *Underwater Acoustics* to *Acoustical Oceanography* to *Biomedical Acoustics* to *Animal Bioacoustics* and then back to *Speech Communication*.

The orientation of this perimeter yields two dimensions, each with a general interpretation. The vertical dimension corresponds to the distinction between a disciplinary focus on artificial and engineered entities at the ***top*** and organic entities in the wild at the ***bottom***. On the horizontal axis, the areas vary from human and cultural to the ***left*** (e.g., music and architecture) and nonhuman (e.g., oceans) to the ***right***.

In terms of how the ASA itself coheres, the MDS analysis suggests an answer. All disciplines are connected by a chain of disciplines made up of pairs of neighbors, each of which have very obvious and important shared interests. They are further connected by *Signal Processing*, which sits in the center and apparently shares members with all other technical areas.

Armed with these results, the sequence of technical neighbors was laid out on the two floors of the Indianapolis Marriott, roughly as in the ***top*** and ***bottom*** halves of the MDS plot in **Figure 1**. More generally, what our analysis shows is how such a diverse organization hangs together. It is a network of allied pairs or triplets of disciplines, each overlapping with different neighbors to form a coherent whole, with *Signal Processing* as a universal interest.

Biosketches

Kenneth de Jong is professor of linguistics at Indiana University, conducting research into the diversity of processes pertaining to speech production and perception, from motor coordination to the acoustic structure of linguistic categories to the acquisition of perceptual abilities in a second language. He was editor in chief of the *Journal of Phonetics*, is president of the Association for Laboratory Phonology, and, most pertinent to this article, was cochair of the 168th meeting of the Acoustical Society of America in Indianapolis.

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