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# Analogue Passive Speaker or Digital “Active” Speaker ?

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## Presentation Objectives

- Theoretical and technical **analysis** of the different solutions
- **Economical** stakes
- Consequences on the **listening experience**



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Analysis of the different solutions

## Terminology

- Passive system: filtered with passive elements
- Active system: filtered with active elements
- Analogue system: physical element filtering
- Digital system: coefficient filtering, processing (gain, delay,...)
- Powered system: amplification inside the enclosure

**Misuse of language:** Active  $\equiv$  Powered



“ Digital Active Speaker ”



“Powered Speaker with Digital Processing”



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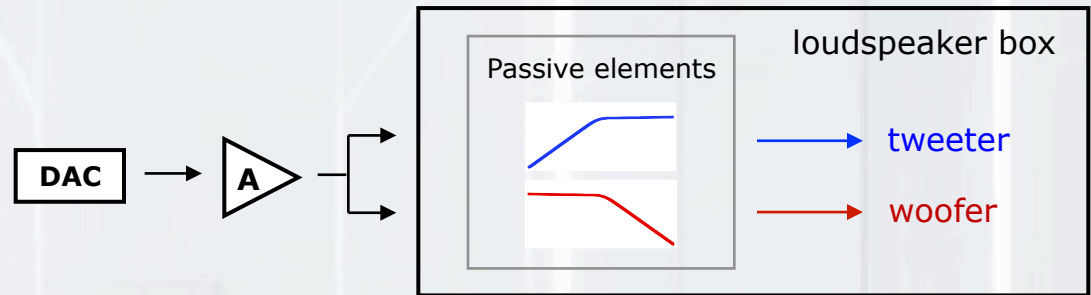
Analysis of the different solutions

## Back in History...

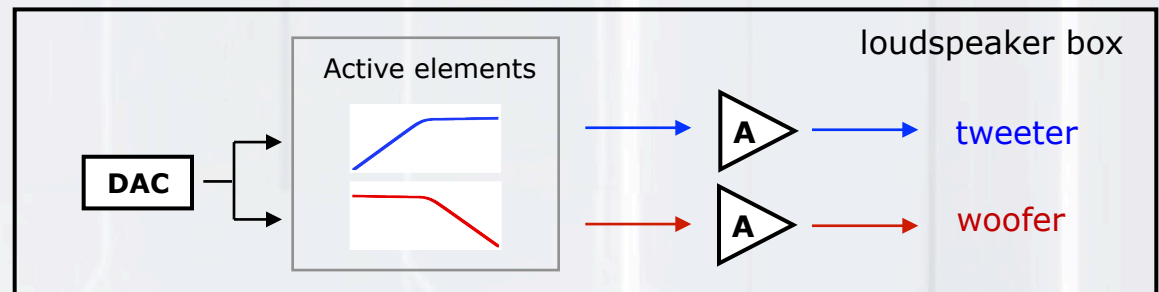
- 1921 (Rice/Kellogs): Moving-coil driver (1W amp / no box)
- 1958 (Cabasse): First active multi-way attempt (valve amp)
- **1960-1973 (Thiele & Small): Modelling of enclosure designs**
- 1967 (Klein-Hummel): Hybrid active 3-way studio monitor
- 1980 (Meyersound): Integrated active 2-way studio monitor
- 1990 (Meridian): First powered loudspeaker with digital filtering for domestic market
- 1994 (Schotz): Patent for a digital wireless speaker system
- 2000: Generalization of digital/analogue powered solutions for professional audio (monitor and sound reinforcement)
- **Why domestic market is years behind pro audio?**

## Standard Solutions for Domestic Market

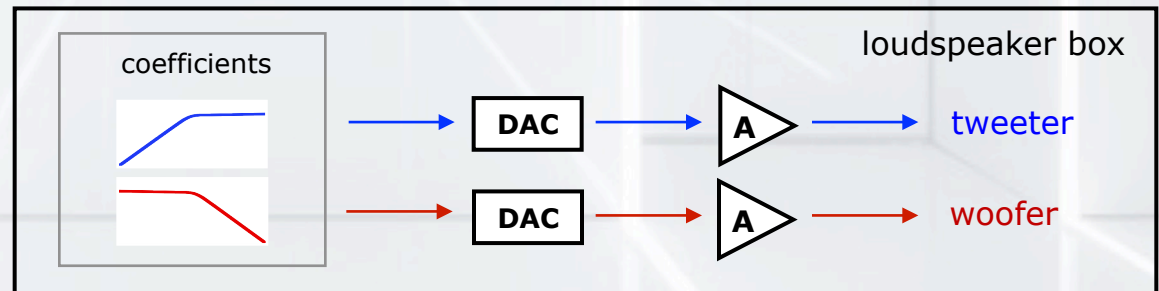
Passive system



Powered system  
(active filtering)



Powered system  
(digital filtering)





## Passive System → Powered System

### Acoustical advantages

- driver holding:
  - amplifier connected to driver terminals
  - shorter analogue cables
  - one amplifier channel per driver
- increased weight
- diffuse field inside the box

### Mechanical disadvantages

- mounting complexity (leakage, element location,...)
- heat dissipation
- electronic noise at the source
- transformer vibration at the source



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Analysis of the different solutions

## Analogue or Digital?

sound production : perfect analogue domain  
sound reproduction : imperfect analogue domain

Analogue	Digital
<p>continuous-time signal</p>	<p>discrete-time signal <i>(solution: higher fs, better antialiasing filter, better conversion and clock control)</i></p>
<p>physical elements <b>disturbance</b> <i>(no solution)</i></p>	<p>physical elements <b>barely impacting</b></p>
<p><b>limited</b> design possibilities <i>(no solution)</i></p>	<p><b>infinite</b> design possibilities</p>
<p><b>limited</b> correction possibilities <i>(no solution)</i></p>	<p><b>infinite</b> correction possibilities</p>



## Filtering technologies

<b>Analogue Passive</b> (resistor / capacitor / inductor)	<b>Analogue Active</b> (transistor / operational amp)	<b>Digital</b> (DSP coefficients)
<ul style="list-style-type: none"><li>- physical pass. elements</li><li>- high tolerance margin</li><li>- variable load (spk)</li><li>- limitation in low freq.</li><li>- long calculation process (external circuit design)</li><li>- long implementation</li><li>- long correction process</li><li>- no easy solution to add extra function</li></ul>	<ul style="list-style-type: none"><li>- physical act. elements</li><li>- low tolerance margin</li><li>- constant load (amp)</li><li>- no limitation in low freq.</li><li>- mid calculation process (integrated circuit design)</li><li>- mid implementation</li><li>- long correction process</li><li>- no easy solution to add extra function</li></ul>	<ul style="list-style-type: none"><li>- no element, but <b>DSP</b></li><li>- no tolerance margin</li><li>- no load</li><li>- no limitation in low freq.</li><li>- short calculation process (no circuit design)</li><li>- short implementation</li><li>- short correction process</li><li>- solutions to add extra functions (gain, delay, distortion correction,...)</li></ul>





## From Passive to Powered Systems

- company investment:
  - amplifier company purchasing or co-branding
  - electronic department setting up
  - new production chain and quality control
- current market improvement:
  - acoustical fidelity improvement
  - price (amp, cables, accessories)
  - WAF effect
- new market development:
  - home theatre implementation
  - designed interior integration
  - wireless possibility



## From Analogue to Digital

- company investment:
  - signal processing and modelling skills
  - DSP software competence
  - amplifier board integration
- current market improvement:
  - room acoustic correction
  - distortion correction (time,...)
  - new format upgrade
- new market development:
  - smaller and embedded solutions
  - user friendly
  - sound modifications, effects (3D,...)
  - ultimate home theatre solutions



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## Consequences on listening experience

### 1. Passive → Powered Active

- better dynamic and low frequency impact
- better stage sound accuracy (stereo image)

### 2. Powered Active → Powered Digital

- better stage sound accuracy (stereo image)
- better coherence (filtering design)

### 3. Digital correction possibilities (time domain)

- better dynamic and low frequency impact
- greater sound clarity
- more spacious and detailed sound environment
- better stage localisation (width/deepness)



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Consequences on listening experience

## Subjective Listening and Comfort Zone

- Analogue aficionado
  - years of listening experiments
  - warm and coloured sound as reference
  - comfort zone
- Attitude towards powered system and digital processing
  - cold and too accurate sound
  - loss of reference
  - no pleasure

**But... those who made the effort to go out of their comfort zone,  
never return to analogue solutions!**