

# Examining the Interactive Effects of Personalization Algorithms (the Filter Bubble) on Network Structure (the Echo Chamber) and the Impact on Radical Beliefs

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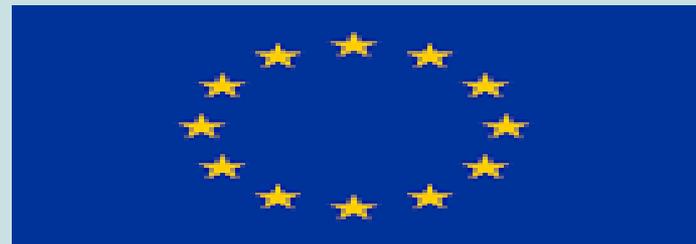


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Modelling the processes leading  
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המכון לקרימינולוגיה  
הפקולטה למשפטים  
האוניברסיטה העברית בירושלים



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# A pressing question

- Is the internet in and of itself a radicalizing agent, an amplifier of radicalization, both, or neither? (Neumann, 2013; O'Hara & Stevens, 2015).

# Today's presentation

- ⦿ Operational definitions of radicalization
- ⦿ Echo chambers
- ⦿ The filter bubble
- ⦿ Criminological theoretical perspectives
- ⦿ The study
- ⦿ The results
- ⦿ Conclusions

# Definitions

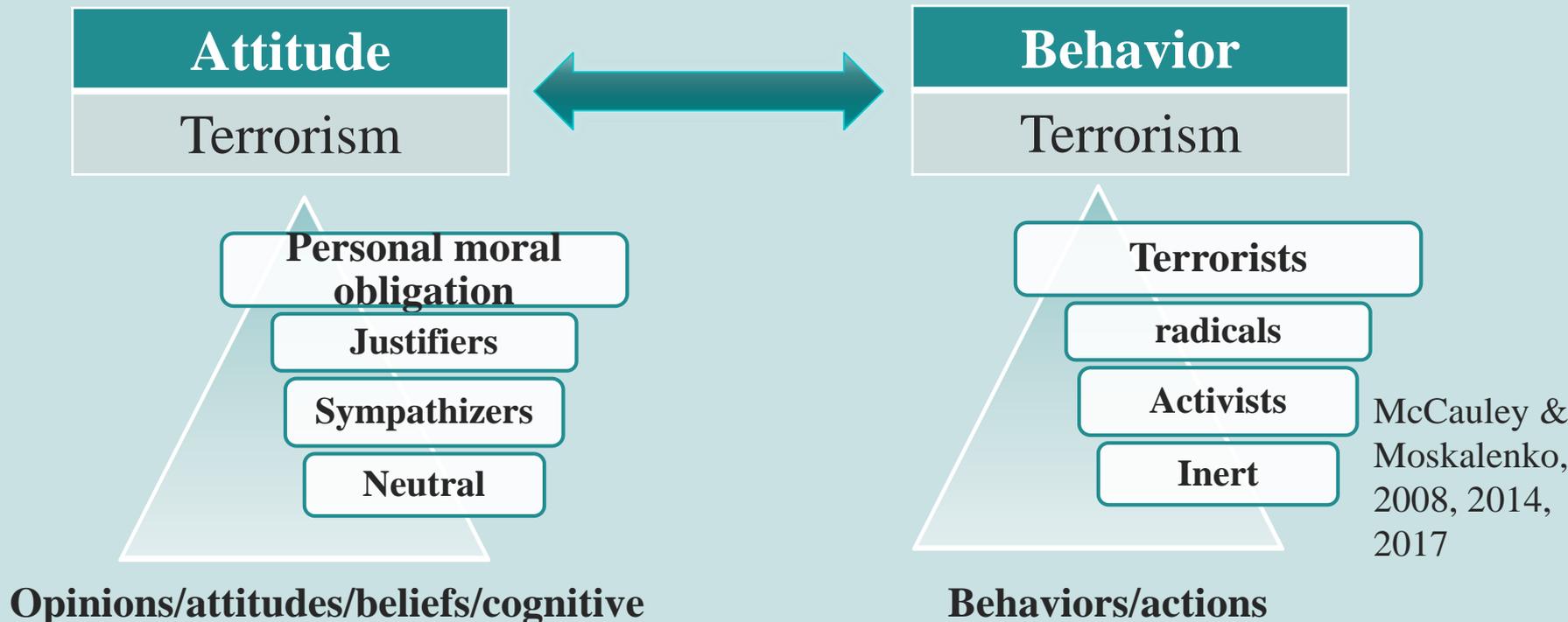
**Radicalization:** *"the phenomenon of people embracing opinions, views and ideas which could lead to acts of terrorism" (EU, 2005)*

**Online radicalization** "a process whereby individuals through their online interactions and exposures to various types of internet content, come to view violence as a legitimate method of solving social and political conflicts" (Berminham, 2009).

# The Two-Pyramid model

*What kind of 'opinions, views and ideas' may lead to acts of terrorism?*

- Attitudes-behavior continuity require measurements at 'Level of specificity' (Fishbein & Ajzen, 1975, 1977; Wicker & Pomazal, 1971; Weigel et-al, 1976).



# The Two-Pyramid Model

- Empirically supported (Gøtzsche-Astrup, 2018).
- Distinguishes between the cognitive and behavioral; attitudes/beliefs and actions/behaviors.
- A model based on outcomes at all 3 levels of the attitude-behavior continuity.
- Meets the level of specificity.
- Accounts for both Violent and non-violent outcomes
- Accounts for why most don't become terrorists
- Assessing support for terrorism or radical violence, including specific events (e.g. suicide bombings, 7/7 bombings) has become the standard way to measure radical attitudes (e.g. Berger, 2016; McCauley, 2012; Tausch, Spears and Christ, 2009; Victoroff, Adelman and Matthews, 2012; Zhirkov, Verkuyten and Weesie, 2014).

# What is an echo chamber?

- ◉ Echo chambers are networks characterized by **homophily**, confirmation bias, **insularity**, polarization, and have insular, dense, and inward focused structures (Sunstein, 2009).
- ◉ Effects may be stronger online than offline (Sunstein, 2017).
- ◉ Can lead to opinion polarization and extremism.
- ◉ Has been suggested to play a role in radicalization and online radicalization (Stevens & Neumann, 2009; Sunstein, 2017; Sunstein, 2007; Von Behr et al., 2013; Warner, 2010; Wojcieszak, 2010; Gilbert et-al, 2009; Del Vicario et-al, 2016a, 2016b)
- ◉ Can be measured quantitatively.

# What is the filter bubble?

- ◉ Always operating...Even while you sleep!
- ◉ Personalization algorithms **decide for us** what we are exposed to and shielded from; “you can’t tell how biased the sample is from looking at the sample alone” (Pariser, 2011).
- ◉ They can lead to “**algorithmic deviancy amplification**”, since a user engaging with deviant material is automatically fed more of the same (Wood, 2017).
- ◉ Evidence of a “radical” filter bubble on Youtube and Twitter (Musa & Bendett, 2010; O’Callaghan et-al, 2013, 2014; Regner, 2014).

# Social structure social learning theory (SSSL)

- Learning of deviant attitudes and behaviors:
  - Is the same as that of normative attitudes and behaviors.
  - Occurs primarily in intimate networks (e.g. family, friends) (Sutherland, 1947).
- Environmental structures may determine availability of sources of definitions and network structure (Akers, 1998; Cloward & Olin, 1960).
- Network structure may be more important to learning than the identity of network members (Haynie, 2001; Burt, 1992; McGloin & Piquero, 2010; McGloin & O'Neill Shermer, 2009).
- This has been suggested with regards to radicalization too (Kennedy & Weimann, 2011; Malthaner & Waldmann 2014)
- Social learning processes** are what occur inside the **network** which is situated within, and shaped by the **social structure** which is determined by **environmental factors**

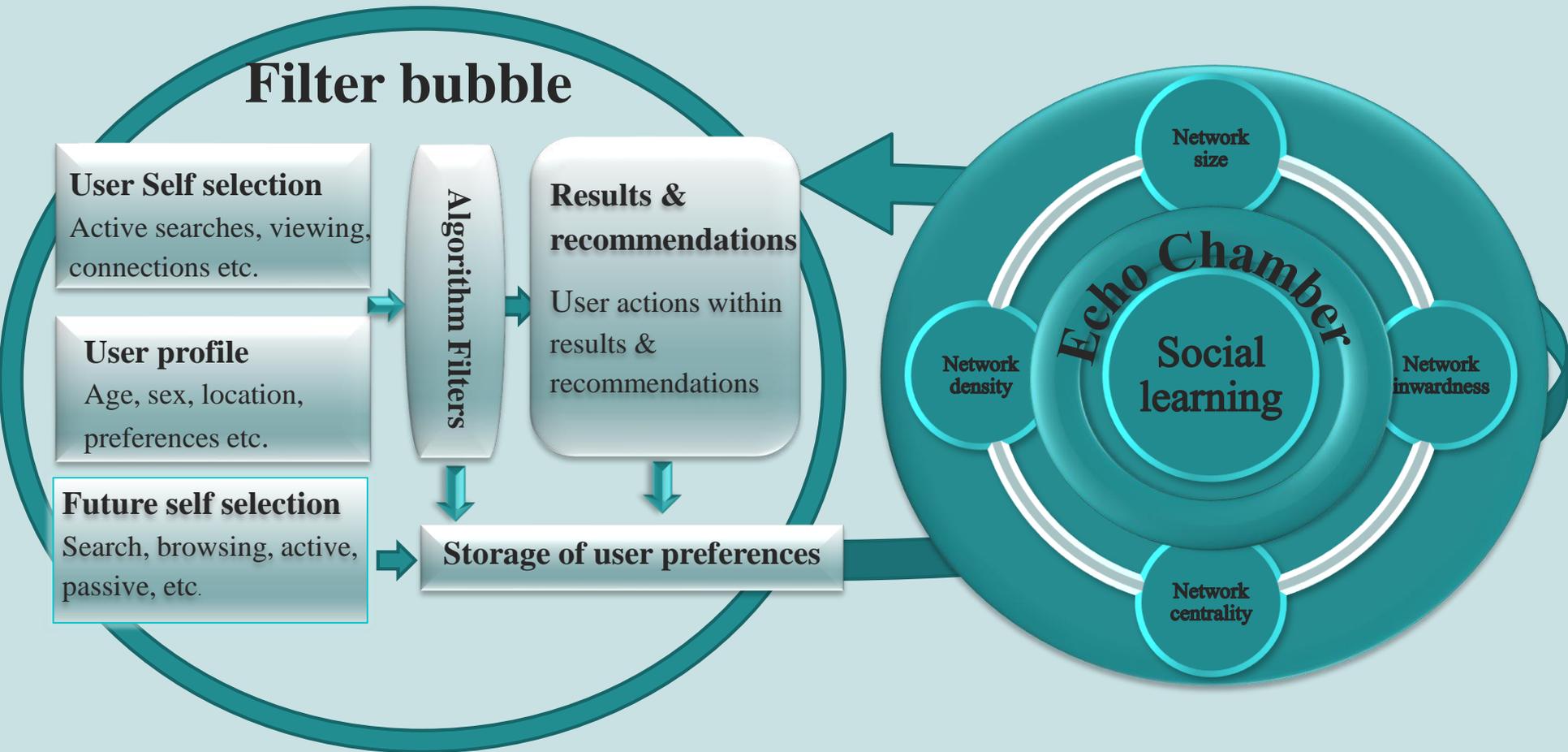
# Social structure social learning theory (SSSL)

- Factors such as network size, network density, and network inwardness have all been found to increase deviant attitudes and behaviors for a range of 'crimes' (Hawdon, Oksanen, and Räsänen 2014; Hawdon, Bernatzky and Costello, 2018; Haynie, 2001; 2002; Haynie et al., 2014; McCuddy & Vogel, 2015; McGloin & O'Neill Shermer, 2009; McGloin & Piquero, 2010)

# The interaction

- ◉ Echo chambers and filter bubbles are too often conflated.
- ◉ They are distinct phenomenon.
- ◉ Filter bubbles are an environmental factor that increase the likelihood of the formation of echo chambers (Weisburd, 2010; Hawdon, 2012; Bessi et-al, 2016).
- ◉ Echo chambers are networks with structural characteristics conducive to, and which have found to be correlated with increased likelihood of deviant attitudes and behaviors.
- ◉ These have potentially important implications for the **learning** of deviant beliefs and behaviors, including with respect to **radicalization** (Schmitt, Rieger, Rutkowski and Ernst, 2018)

# The “filter bubble” and the “echo chamber”



# The gap in the literature

- ⦿ A small number of quantitative studies exist (Gill et al., 2017).
- ⦿ Few experimental.
- ⦿ **None** have looked at network structure characteristics.
- ⦿ Tests of social learning have been limited to only 1-2 dimensions.

# Research questions

- ① Does the filter bubble affect the degree to which networks can be characterized as echo chambers?
- ① Are echo chamber network characteristics associated with radical attitudes?
- ① Is there an interactive effect between the filter bubble and echo chamber in predicting radical attitudes?

# Sample

- Random sample of 115 new Twitter users (84% retention).
- All participants were residents of East Jerusalem and the West Bank
- Randomization showed equal groups

Factor	Treatment	Control
Age	19.021 (2.480)	18.306 (1.432)
% Female	85.1%	83.7%
Education	2.867 (1.036)	2.959 (.912)

# Method

- ⦿ Treatment:
  - Deactivation of personalization settings on Twitter and ignoring all recommendations on sign-up.
- ⦿ Dependent variable:
  - Justification of suicide bombings
    - (5-point Likert scale)
    - Derived from participant survey

# Variables

## Main independent variables

- ⦿ *E-I ratio*: The ratio of external to internal ties measures network inwardness/insularity
  - Used as a proxy for echo chambers (Bright, 2016; Hargittai et al, 2008; Everton & Cunningham, 2015; Everton, Cunningham & Murphy, 2016).

$$E - I \text{ Ratio} = \frac{G_e - G_i}{G_e + G_i}$$

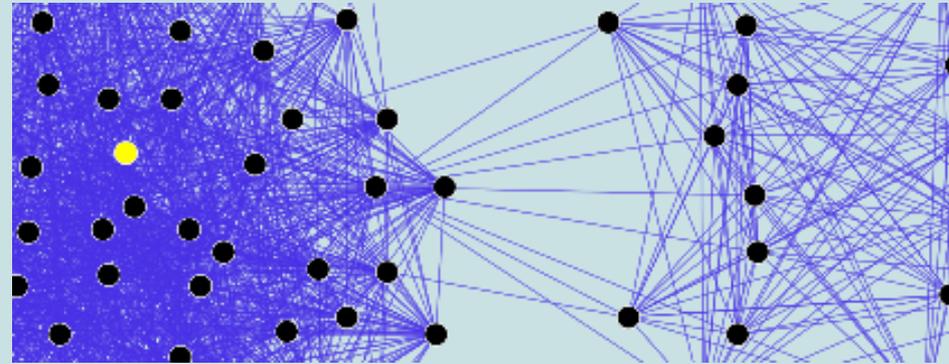
- ⦿ *Modularity*: Community/sub-community structure
  - Used as a proxy for echo chambers
- ⦿ *Eigenvector centrality*: The importance of a member in a network based on centrality of the node's connections.
- ⦿ *Vector reciprocity*: The proportion of mutual/returned ties

## Other variables

- ⦿ *Treatment*: A dichotomous variable
- ⦿ *#of ties*:
  - A known predictor of deviant attitudes and behaviors (e.g. McCuddy and Vogel (2015a, 2015b))

# Analytic procedure

- After four months of Twitter usage, Social network analysis was carried out for each participant.
- Ordinal logistic regression models with interaction effects.



# Results

	Model 1	Model 2
Treatment	0.214 (0.408)	-.452 (.838)
Ties	0.023 (0.009)**	.026 (.010)**
EI ratio	-1.328 (1.156)	.900 (1.589)
Reciprocated vertex	-1.280 (1.592)	2.091 (2.004)
Eigenvector centrality	3.740 (2.064)+	5.427 (2.471)*
Modularity	-3.310 (3.256)	-.037 (3.999)
Treatment X EI ratio		-1.481 (.755)*
Treatment X Reciprocated		-1.679 (.649)**
Treatment X Eigenvector		-.575 (.544)
Treatment X modularity		-.455 (.416)
R <sup>2</sup> (Nagelkerke)	.423	.479

\*\*<.01, \*<.05, +<.10

# Discussion

- ⦿ Treatment has no effect on its own.
- ⦿ Network size (ties), and centrality have a positive effect on the odds of holding radical beliefs
- ⦿ Primary elements of echo chamber operate in hypothesized direction.
- ⦿ There is an interactive effect between the treatment and primary elements of echo chamber in increasing the odds of holding radical beliefs

# Discussion

- ◎ Strength of weak ties theory
  - Strong ties increase social attachment and social control, weak ties provide increased opportunities for acceptance and reinforcement (Granovetter, 1983)
  - Larger networks made up of weak ties increases the likelihood of radicalization (Kennedy & Weimann, 2011).
  - Terrorist networks are often characterized by a large number of weak ties (Varanese, 2016).

# Additional considerations

- ⦿ Density was removed due to multicollinearity
- ⦿ Sensitivity analyses show that it has no effect on results
- ⦿ Additional centrality measures exist
- ⦿ Future analyses will incorporate other network variables and survey items as well.
- ⦿ Survey includes other important items for use in future research.

# Conclusions

The degree to which networks can be characterized as echo chambers appears to have an effect on radical beliefs.

## **Prediction utility**

- ⦿ Network structure characteristics may predict the likelihood of radicalization better than individual level factors.

## **Policy considerations**

- ⦿ Personalization algorithms likely play a role in network formation and/or have an interactive effect with network structure in increasing/reducing the risk of radicalization.
- ⦿ Personalization algorithms can be used for good and bad; If they can identify radicals and feed them more, they can be harnessed to promote counter-messaging too, and thereby reduce the effects of the filter bubble and echo chamber.