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Online Social Behaviors in the Context of Religiosity: A Neural-Networks-Supported Approach to Theists and Atheists

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Abstract: Social media behaviors include those of a religious nature. This paper investigates psychological traits, perceptions, and attitudinal variables concerning manifestations of religiosity on social media of both theists and atheists, as the latter are more overlooked in previous studies. A total of 1358 participants completed a questionnaire. The results suggest associations between the studied variables and religiosity, and differences between theists and atheists. Additionally, this study incorporated artificial neural networks to verify whether religiosity may be grounds for a classification model in the case of online social behaviors. The model correctly predicted 79% of cases. This study examined religiosity from the perspectives of anxiety, coping, social support, discrimination, and social media expectations and behaviors, and showed that religiosity is an important factor to include in online social behavior studies.

Keywords: religion; social media; online behaviors; artificial neural networks; psychological traits

Citation: Jablonska, Marta Regina. 2022. Online Social Behaviors in the Context of Religiosity: A Neural-Networks-Supported Approach to Theists and Atheists. *Religions* 13: 1021. https://doi.org/10.3390/rel13111021

Academic Editor: Roberto Cipriani

Received: 24 August 2022
Accepted: 7 October 2022
Published: 26 October 2022

1. Introduction

Social media acts like a magnifying glass, in that it concentrates attention on and reinforces aspects of human behaviors (Qureshi-Hurst 2021). It not only allows for the free expression of one's own self and the expression of behaviors manifested in everyday life, but also for the creation of new identities and behavior patterns typical of digital spaces. The multitude of users from different parts of the world with various demographic, social, economic, and cultural backgrounds makes social media a buzzing melting pot of constructive and destructive social behaviors. Social media contains a wealth of data about other people against which users can compare themselves, verifying their own life expectations, achievements, as well as physical appearance, and imagining what they should look like. The plethora of users makes it easy to find those who out-perform such observers, which can have a seriously damaging effect on self-worth, encouraging people to pursue unrealizable goals and contributing to intense feelings of estrangement (Qureshi-Hurst 2021). The same multiplicity of users also makes it possible to establish contact with people with similar interests and values, broadening social circles, which can result in greater social support. Social media may serve as a remedy for the increasing sense of loneliness and social isolation and feeling disconnected from society (Titgemeyer and Schaaf 2020). The increasing number of people turning to social media for social support is confirmed by a substantial amount of literature (Keating 2013). Online media are also seen as a form of social activity to engage in with peers and others and are considered worldwide to be a key aspect of active and healthy aging, and correlated with a good quality of life (Rochat et al. 2018). Such practices may also be relevant to young people who prefer online communication to traditional face-to-face support (Han et al. 2018; Kauer et al. 2014) and those with limited access to the latter (Wong et al. 2021).

Social media activities may be of a spiritual nature. Scholars have long since recognized the potential of classic websites in the area of religiosity, as people use them for information searches, entertainment, to donate money and be involved in religious communities, and

finally, to explore and reinforce their faith (Brubaker and Haigh 2017; Laney 2005). However, in the context of social media, limited research is available (Brubaker and Haigh 2017). As new online media are capable of playing powerful roles in one's social life (Davidson and Farquhar 2014) and have become a major communication vehicle in all societies (Jafarkarimi et al. 2016), the scope of such research should be broadened.

This article focuses on manifestations of religiosity on social media and its related behaviors. For this purpose, religiosity is understood as belonging to a specific church and participating in religious services (Pastwa-Wojciechowska et al. 2021). The combination of religiosity, social behaviors, and psychological traits in this study is justified on the basis of the relationships described by Dangerfield et al. (2019) and Pastwa-Wojciechowska et al. (2021): increased religiosity may be a solution for present psychological problems and mental disorders, by offering relief from them or even reducing their symptoms, and providing a chance to constructively cope with social stressors, problems, and identity development. However, it can also have the opposite effect, exacerbating the symptoms of certain disorders. Research on the influence of religiosity on wellbeing is twofold. On the one hand, researchers indicate its positive impact, promoting mental health (Ellison and Fan 2008; Pargament et al. 2013; Pastwa-Wojciechowska et al. 2021); on the other hand, it is a potentially problematic aspect of religious life, as religious struggles may result in tensions, conflicts, and concerns about sacred matters, leading to reduced well-being (Exline 2013; Sedlar et al. 2018). Although many have tried to clarify religious concepts and their relationships from a theoretical, empirical, and meta-analytical standpoint (De Vincenzo et al. 2022), Davidson and Farquhar (2014) point directly to the lack of research into psychological traits in relation to religion in online arenas. Brubaker and Haigh (2017) note that, considering the brisk adoption of social media, it is not surprising that individuals, religious leaders, and congregations have used it to bolster religious participation. Social media is used for reciprocal engagement with faith-based content (Brubaker and Haigh 2017), both among like-minded individuals and those of different faiths, because it promotes communication about cultural practices, beliefs, and experiences without geographical restrictions (Miller et al. 2013). In addition, social media allows users to interact freely and improve relationships between believers and may bring younger generations closer to religion (Brubaker and Haigh 2017). Another strand of research concerns the harassment of religious people through hate speech (Kastolani 2020; Nor and Gale 2021). The social media perspective on religiosity has become a relevant research domain, although its relation to psychological traits is still poorly recognized and underexplored.

The focus on theists and atheists is justified by several factors. The premise that religion influences online behavior in social media is put forward by Turan (2018), who argues that an increase in religiosity leads to a reduction in the number of social media tools used. Other studies posit that online social behaviors may be both quantitatively and qualitatively different between religious and non-religious groups (Keating 2013; Kleman et al. 2009). From an emotional standpoint, research has indicated that being religious, which is associated with surrendering control to God, may cause different behaviors and coping patterns among those facing life-threatening events who gain strength from biblical verses, prayers, and scriptural readings, appraise difficult situations as the will of a purposeful god(s), and finally, believe that god(s) give(s) individuals the skills and resources they need to deal with their problems (Shaw et al. 2007). Moreover, the common use of social media has shifted the way that many religious individuals, leaders, and congregations worship and proselytize, and take advantage of social media to boost religious participation (Brubaker and Haigh 2017). Equally interesting, but less represented in the research, are atheists. The majority of the literature in this area relies on samples consisting predominantly of participants who believe in some kind of deity (Sedlar et al. 2018). It is important to note that, although the number of atheists is increasing, research examining this group remains scarce (Cantone et al. 2022). Thus, based on articles pointing to possible differences in behavior between believers and non-believers, this work aims to broaden the knowledge of the differences and similarities among the two groups in the context of online social behaviors.

The literature mentioned above views the problem of the relationship between religiosity and social behaviors from different angles and levels, but these works generally arrive at context-dependent results concerning believers or single aspects of communication. The author speculates that there might be another way to investigate online manifestations of religiosity. The identified problem is that, in the literature, online religiosity studies should be expanded to include a comparison between believers and atheists, as well as psychological traits.

Summarizing the literature review, this paper responds to the call by Keating (2013), Sedlar et al. (2018), and Cantone et al. (2022) to investigate psychological traits, perceptions, and attitudinal variables in research on atheists, as they are as important as religious people but more overlooked. Additionally, according to Brubaker and Haigh (2017), engaging with religious content and communities in social media is increasingly important to gain a better understanding of the online behaviors and psychology of religion. To broaden the insights available about the role of religion on online social behaviors, the author also studies the links between religiosity, behavior patterns, and psychological scales. First, the tie between religiosity and anxiety is a rather prevalent topic in the works on the psychology of religion (Śliwak and Zarzycka 2012), and the literature also seems to agree on the rapid increase in anxiety disorders among young people, a tendency attributed to social media usage (Keles et al. 2019; Qureshi-Hurst 2021). Furthermore, the nature of the relationship between religiosity and anxiety is not clear-cut because, on the one hand, religiosity reduces anxiety states, but on the other hand, religious struggles can exacerbate them (Zarzycka et al. 2017). Thus, anxiety has been included in this study. A vast amount of research supports the idea that atheists face significant stigma and prejudice (Sedlar et al. 2018). As discrimination is a common stressor and social support via social media may be a substantial protective factor for psychological distress (Steers et al. 2019), a discrimination scale was used to better understand its particulars. It is also important for the assumptions of this study that although atheists often face serious bias and stigma, empirical research examining this issue remains scarce (Abbott et al. 2021; Cantone et al. 2022; Cragun et al. 2012; Gervais and Najle 2018). Continuing the topic of intolerance, some members of religious—especially more traditional—communities adopt a prejudiced attitude toward LGBT people, contributing to the condemnation of homosexuality, the persecution of sexual minorities, and the infringement of their human rights (Cerbone and Danzer 2017; Hamblin and Gross 2014; Zarzycka et al. 2017). In this sense, possible religion-related strains emerge in sexual minorities, but they should also be discussed from the perspective of religious coping, which can help LGBT individuals overcome life challenges and social stressors related to their sexual orientation (Dangerfield et al. 2019; Liboro 2020; Quinn and Dickson-Gomez 2016). Thus, sexual orientation is also studied in this paper. Finally, ending the topic of persecution, it is important to mention the use of social media to spread hate speech, including in a religious context (Kastolani 2020). As social media content may portray a topic in an unfavorable manner, it can lead to generalizations and stereotypes, leading society to perceive religious groups negatively (Nor and Gale 2021). Therefore, using hate speech was included in this study as well. Previous studies noted correlations between religious involvement and stress management, as faith may be a source of comfort and a helpful way of coping with stress (Zarzycka et al. 2017). Coping appertains to reducing, tolerating, or mastering stress and generally falls into two extensive categories: emotion-focused coping which distracts from the stressor, and problem-based coping which draws attention to it (Abbott et al. 2021; Mc Hugh et al. 2016). Religion can provide a framework for accepting emotional and physical suffering and can improve patience or acknowledgment in the face of stress (Kızılgeçit and Çinici 2020). While religion is used more often than other coping methods, particularly among the elderly, minorities, and individuals facing life-threatening crises (Kızılgeçit and Çinici 2020), little is known about the manner in which non-religious people cope with stress (Abbott et al. 2021)—an omission the current study sought to address. When describing coping, one should also refer to online social support that individuals receive in online settings as, by providing

a sense of reassurance, validation, and acceptance, it may also safeguard them against negative stressors (Keating 2013; Liu and Ma 2019). Behavioral assistance, advice provision, and the perceived availability of support may help individuals to challenge the validity of stressors and reduce negative feelings about the self, thereby reducing the negative impact on mental health and wellbeing (Steers et al. 2019). In spite of the large amount of research on social media, there is much to explore regarding online social support, especially in terms of online religious support (Keating 2013). The intensity of consumption, level of visibility, and number of social media platforms in use may also be related to religiosity (Turan 2018). As it turns out, social media activity in the religiousness context has not attracted significant scholarly interest yet. The research to date mainly addresses the social media activity of religious communities, leaders, and media, without reference to in-depth analyses of its influence on wellbeing and psychological traits (Cardoso and Barraco 2019; Graca 2020; Kaczmarek-Śliwińska et al. 2022). Although there have also been attempts to present the social media activity of representatives of particular denominations, such as Jews and Muslims (Ichau et al. 2019; Kastolani 2020; Nor and Gale 2021), no studies on atheists have been found. This means that there is a gap in the literature, which this paper aims to fill. Thus, it can be concluded that while the literature surrounding religiosity is broad, the issue has not been commonly researched in relation to online religious behaviors among theists and atheists.

To the best of the author's knowledge, there is no study that has examined the relationship between religiosity, anxiety, coping, social support, discrimination, and social media expectations and behaviors, using social media. Therefore, this study aims at bridging the research gap by investigating the above psychological traits, as well as attitudinal variables concerning online behaviors and socio-demographic factors. In view of this need for more nuanced studies to determine possible relations between online social behaviors and religiosity, the author has designed a two-step study. As neither existing research nor theoretical assumptions have allowed for the formulation of hypotheses, including differences in religiosity (theists and atheists), the first part of this study remains exploratory in nature. The following detailed research questions were asked in this paper:

RQ1: Are there any differences and similarities between anxiety levels among religious and atheistic social media users?

RQ2: Are there any differences and similarities between coping strategies among religious and atheistic social media users?

RQ3: Are there any differences and similarities between online social support expectations among religious and atheistic social media users?

RQ4: Are there any differences and similarities between discrimination experienced by religious and atheistic social media users?

RQ5: Are there any differences and similarities between social media expectations among religious and atheistic social media users?

RQ6: Are there any differences and similarities between social media usage intensity among religious and atheistic social media users?

RQ7: Are there any differences and similarities between attitudes towards online behaviors related to hate speech among religious and atheistic social media users?

RQ8: Are there any differences and similarities between attitudes towards the perceived influence of social media on mood, self-esteem, and life satisfaction among religious and atheistic social media users?

The second part of the study aims to answer the question of whether the above variables can differentiate both groups strongly enough to be able to build a classification model based on them, which would counteract religiosity or atheism. Is it possible to make predictions about being a religious person or an atheist and selected psychological traits and behaviors related to social media activity? Despite the rapid adoption of online media in the religious realm, limited research is available on engagement with religious content and wellbeing, making it increasingly important to gain a better understanding about the strength of such relations. That is why the author incorporated artificial neural networks

(ANNs) to verify whether the relationships between the analyzed variables are strong enough for the networks to learn to classify individual groups, distinguishing between religious individuals and atheists. ANNs do not need physical pre-information before modeling, so they can be designed for complex or novel tasks where potential relations between data remain unknown. Therefore, they fit well into the exploratory nature of this study. Such networks analyze data, learn from it, and classify or predict (Srividya et al. 2018). Despite the fact that ANNs are increasingly finding their way into social research and can efficiently predict behaviors, emotions, and personality traits (Kuzma and Andrejková 2016; Srividya et al. 2018), little is known about their usefulness in religious studies. The only example found of such a study is the one by Kızılgeçit and Çinici (2020) on the prediction of individuals' religious coping levels during COVID-19. This study intends to fill this research gap by building a predictive model on social media activity and religiosity. Thus, the last research question is formulated as follows:

RQ9: Are artificial neural networks capable of predicting the religiousness of social media users based on their psychological traits and social behaviors?

To summarize, this study looks at the social media activities through a lens of psychological traits and social behaviors of believers and non-believers. The author believes that this is an important factor in expanding the scope of knowledge on religiosity and social media.

This paper is structured as follows. The subsequent section describes the methodology and data. It thoroughly explains the psychological scales, attitudinal variables, data source, sample, the artificial neural networks, and statistical method applied. This part is followed by a section which presents the results. Then follows a discussion of the findings on the manifestation of religiosity in social media and related behaviors in the context of research questions. This paper ends with concluding thoughts, implications, and limitations.

2. Results

First, the Mann–Whitney U test with the continuity correction was applied to establish differences between theist and atheist groups in terms of the variables tested (Table 1).

Calculated Spearman's rho coefficients among the studied variables and religiousness for the subgroups of theists and atheists are presented in Table 2.

Table 1. Comparison of study variables between theists and atheists.

	Theists		**Atheists**				
	N = 891		**N = 467**				
	M	**SD**	**M**	**SD**	**U Mann–Whitney (Z)**	***p***	
SM Intensity	1.589	0.984	2.204	0.924	137,313.5	0.000	***
OSSS_Esteem/Emotional Support	1.143	0.737	1.569	0.767	143,879.0	0.000	***
OSSS_Social Companionship	1.226	0.771	1.679	0.721	138,399.0	0.000	***
OSSS_Informational Support	1.258	0.759	1.679	0.724	141,351.5	0.000	***
OSSS_Instrumental Support	0.852	0.675	1.190	0.798	156,577.0	0.000	***
Everyday Discrimination	0.335	0.457	0.416	0.470	182,957.0	0.000	***
STAI_State Anxiety	0.365	0.456	0.399	0.526	205,754.0	0.728	
STAI_Trait Anxiety	1.351	0.823	1.381	0.899	204,499.5	0.604	
COPE_social support	1.454	0.541	1.336	0.518	179,637.5	0.000	***
COPE_problem solving	1.840	0.635	1.999	0.666	176,829.0	0.000	***
COPE_avoidance	1.259	0.583	1.273	0.624	204,921.5	0.648	
COPE_positive thinking	1.713	0.592	1.794	0.589	193,202.0	0.030	*
SM_Interpersonal expectations	1.849	1.101	2.422	0.994	146,356.5	0.000	***
SM_Pragmatic expectations	2.245	1.089	2.831	0.760	140,630.0	0.000	***
SM_Hedonistic expectations	1.827	1.057	2.369	0.902	147,977.0	0.000	***
SM_Compensatory expectations	1.497	1.013	1.962	1.084	158,040.0	0.000	***
Posting selfies	0.975	1.163	1.657	1.543	159,935.0	0.000	***
Non-face avatars	1.195	1.222	1.075	1.233	193,848.0	0.029	*
SM annoying	1.418	1.090	1.433	1.095	207,251.0	0.904	
SM mood decreasing	1.165	0.999	1.120	0.969	203,219.0	0.453	
SM self-esteem decreasing	1.264	1.157	1.206	1.118	203,211.5	0.460	
SM life satisfaction decreasing	1.226	1.138	1.236	1.137	206,542.5	0.818	
Hater	0.363	0.786	0.441	0.763	190,971.5	0.001	**
Vulgar language	0.790	1.144	1.094	1.265	177,858.0	0.000	***

Note: SM = social media. *p* Values < 0.05 *, <0.01 **, <0.001 ***.

Table 2. Correlation of study variables for the subgroups of theists and atheists.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	SM Intensity	OSSS_Esteem/Emotional Support	OSSS_Social Companionship	OSSS_Informational Support	OSSS_Instrumental Support	Everyday Discrimination	STAI_State Anxiety	STAI_Trait Anxiety	COPE_Social Support	COPE_Problem Solving	COPE_Avoidance	COPE_Positive Thinking	SM_Interpersonal Expectations	SM_Pragmatic Expectations	SM_Hedonistic Expectations	SM_Compensatory Expectations	Posting selfies	Non-Face Avatars	SM Annoying	SM Mood Decreasing	SM Self-Esteem Decreasing	SM Life Satisfaction Decreasing	Hater	Vulgar Language
1	—	**0.64** ***	**0.61** ***	**0.62** ***	**0.65** ***	0.12 **	0.04	0.28 ***	0.10 *	−0.07	0.33 ***	0.21 ***	**0.66** ***	**0.61** ***	**0.75** ***	**0.69** ***	**0.68** ***	−0.44 ***	−0.40 ***	−0.28 ***	−0.13 **	−0.17 ***	0.13 **	0.19 ***
2	**0.67** ***	—	**0.78** ***	**0.78** ***	**0.73** ***	0.08	−0.08	0.18 ***	0.13 **	0.14 **	0.21 ***	0.35 ***	**0.71** ***	**0.56** ***	**0.67** ***	**0.71** ***	**0.68** ***	−0.43 ***	−0.48 ***	−0.43 ***	−0.34 ***	−0.36 ***	0.07	0.16 ***
3	**0.68** ***	**0.79** ***	—	**0.78** ***	**0.71** ***	0.22 ***	0.03	0.23 ***	0.18 ***	0.12 **	0.25 ***	0.27 ***	**0.72** ***	**0.61** ***	**0.68** ***	**0.63** ***	**0.54** ***	−0.38 ***	−0.37 ***	−0.36 ***	−0.26 ***	−0.29 ***	0.09 *	0.19 ***
4	**0.66** ***	**0.73** ***	**0.79** ***	—	**0.80** ***	0.16 ***	−0.02	0.22 ***	0.16 ***	0.11 *	0.27 ***	0.32 ***	**0.72** ***	**0.67** ***	**0.68** ***	**0.67** ***	**0.53** ***	−0.36 ***	−0.38 ***	−0.32 ***	−0.24 ***	−0.25 ***	0.08	0.17 ***
5	**0.63** ***	**0.73** ***	**0.75** ***	**0.79** ***	—	0.22 ***	0.01	0.19 ***	0.11 *	0.04	0.32 ***	0.30 ***	**0.71** ***	**0.60** ***	**0.70** ***	**0.76** ***	**0.61** ***	−0.37 ***	−0.45 ***	−0.33 ***	−0.27 ***	−0.25 ***	0.19 ***	0.24 ***
6	0.29 ***	0.28 ***	0.35 ***	0.32 ***	0.39 ***	—	0.37 ***	0.28 ***	0.07	−0.02	0.19 ***	−0.02	0.12 **	0.13 **	0.12 *	0.12 **	0.05	0.10 *	0.10 *	0.09 *	0.06	0.10 *	0.18 ***	0.17 ***
7	−0.02	−0.13 ***	−0.03	−0.04	−0.04	0.30 ***	—	0.38 ***	0.09	−0.13 **	0.24 ***	−0.10 *	−0.06	−0.02	−0.03	−0.06	−0.07	0.11 *	0.22 ***	0.27 ***	0.19 ***	0.25 ***	0.07	0.08
8	0.09 **	0.03	0.04	0.10 **	0.06	0.12 ***	0.34 ***	—	0.00	−0.06	**0.51** ***	0.03	0.16 ***	0.25 ***	0.25 ***	0.22 ***	0.18 ***	−0.10 *	−0.08	0.05	0.14 **	0.12 **	0.01	0.14 **
9	−0.02	0.06	0.06	0.09 **	0.02	−0.12 ***	0.08	0.23 ***	—	0.34 ***	−0.05	0.11 *	0.09	0.25 ***	0.07	−0.07	−0.04	−0.06	0.05	0.08	−0.03	−0.05	−0.07	0.00
10	0.12 ***	0.23 ***	0.25 ***	0.25 ***	0.16 ***	−0.03	−0.10 **	0.04	0.37 ***	—	−0.06	0.22 ***	0.07	0.19 ***	−0.01	−0.05	0.02	−0.12 **	−0.06	−0.11 *	−0.16 ***	−0.17 ***	−0.14 **	−0.12 **
11	−0.04	−0.04	−0.07 *	−0.01	0.04	0.08 *	0.16 ***	**0.50** ***	0.10 **	0.01	—	0.21 ***	0.23 ***	0.25 ***	0.32 ***	0.42 ***	0.28 ***	−0.04	−0.15 **	−0.01	0.13 **	0.14 **	0.21 ***	0.34 ***
12	−0.07 *	0.11 ***	0.06	0.05	0.07 *	−0.08 *	−0.21 ***	0.09 *	0.11 **	0.16 ***	0.23 ***	—	0.28 ***	0.25 ***	0.24 ***	0.33 ***	0.26 ***	−0.11 *	−0.29 ***	−0.26 ***	−0.10 *	−0.15 **	0.03	0.20 ***

Table 2. *Cont.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	SM Intensity	**OSSS_Esteem/Emotional Support**	**OSSS_Social Companionship**	**OSSS_Informational Support**	**OSSS_Instrumental Support**	**Everyday Discrimination**	**STAI_State Anxiety**	**STAI_Trait Anxiety**	**COPE_Social Support**	**COPE_Problem Solving**	**COPE_Avoidance**	**COPE_Positive Thinking**	**SM_Interpersonal Expectations**	**SM_Pragmatic Expectations**	**SM_Hedonistic Expectations**	**SM_Compensatory Expectations**	**Posting selfies**	**Non-Face Avatars**	**SM Annoying**	**SM Mood Decreasing**	**SM Self-Esteem Decreasing**	**SM Life Satisfaction Decreasing**	**Hater**	**Vulgar Language**
13	**0.69** ***	**0.68** ***	**0.74** ***	**0.76** ***	**0.68** ***	0.28 ***	−0.07	0.04	0.02	0.19 ***	−0.02	0.07 *	—	**0.68** ***	**0.79** ***	**0.79** ***	**0.57** ***	−0.37 ***	−0.40 ***	−0.38 ***	−0.25 ***	−0.30 ***	0.11 *	0.19 ***
14	**0.69** ***	**0.62** ***	**0.69** ***	**0.72** ***	**0.62** ***	0.20 ***	−0.09 **	0.07 *	0.09 **	0.33 ***	−0.04	0.03	**0.79** ***	—	**0.72** ***	**0.55** ***	0.43 ***	−0.33 ***	−0.30 ***	−0.29 ***	−0.21 ***	−0.26 ***	−0.03	0.08
15	**0.78** ***	**0.67** ***	**0.69** ***	**0.73** ***	**0.64** ***	0.27 ***	−0.05	0.10 **	0.04	0.19 ***	0.02	0.01	**0.82** ***	**0.82** ***	—	**0.77** ***	**0.57** ***	−0.37 ***	−0.43 ***	−0.38 ***	−0.21 ***	−0.29 ***	0.11 *	0.19 ***
16	**0.60** ***	**0.65** ***	**0.58** ***	**0.62** ***	**0.67** ***	0.33 ***	−0.10 **	0.10 **	−0.15 ***	0.06	0.19 ***	0.20 ***	**0.73** ***	**0.60** ***	**0.72** ***	—	**0.70** ***	−0.37 ***	**−0.51** ***	−0.39 ***	−0.22 ***	−0.23 ***	0.27 ***	0.34 ***
17	**0.55** ***	**0.57** ***	0.44 ***	0.47 ***	0.47 ***	0.18 ***	−0.12 ***	0.08 *	−0.03	0.11 ***	0.07 *	0.10 **	**0.51** ***	0.45 ***	**0.51** ***	**0.59** ***	—	**−0.50** ***	−0.47 ***	−0.35 ***	−0.20 ***	−0.26 ***	0.13 **	0.21 ***
18	−0.05	−0.05	−0.02	0.02	0.02	0.22 ***	0.01	−0.18 ***	−0.24 ***	−0.10 **	−0.12 ***	−0.07 *	0.02	0.00	−0.02	0.07 *	−0.11 ***	—	0.41 ***	0.36 ***	0.25 ***	0.27 ***	0.11 *	0.10 *
19	0.15 ***	0.06	0.17 ***	0.14 ***	0.12 ***	0.29 ***	0.10 **	−0.16 ***	−0.17 ***	−0.02	−0.23 ***	−0.28 ***	0.13 ***	0.14 ***	0.09 *	0.05	−0.01	0.47 ***	—	**0.61** ***	0.44 ***	0.43 ***	−0.01	−0.07
20	0.16 ***	0.07 *	0.14 ***	0.15 ***	0.16 ***	0.33 ***	0.15 ***	−0.06	−0.19 ***	−0.03	−0.10 **	−0.21 ***	0.13 ***	0.11 ***	0.10 **	0.15 ***	0.06	0.45 ***	**0.71** ***	—	**0.60** ***	**0.64** ***	0.07	0.01
21	0.24 ***	0.09 **	0.12 ***	0.16 ***	0.16 ***	0.25 ***	0.10 **	0.07 *	−0.19 ***	−0.07 *	0.05	−0.10 **	0.17 ***	0.14 ***	0.20 ***	0.25 ***	0.14 ***	0.36 ***	0.49 ***	**0.62** ***	—	**0.78** ***	0.07	0.08
22	0.25 ***	0.10 **	0.13 ***	0.17 ***	0.20 ***	0.30 ***	0.09 **	0.05	−0.20 ***	−0.06	0.04	−0.11 ***	0.16 ***	0.16 ***	0.18 ***	0.26 ***	0.13 ***	0.37 ***	**0.51** ***	**0.63** ***	**0.86** ***	—	0.12 **	0.09
23	0.15 ***	0.19 ***	0.16 ***	0.16 ***	0.27 ***	0.30 ***	0.05	−0.02	−0.18 ***	−0.08 *	0.18 ***	0.01	0.15 ***	0.03	0.16 ***	0.36 ***	0.24 ***	0.18 ***	0.11 **	0.20 ***	0.19 ***	0.17 ***	—	0.49 ***
24	0.23 ***	0.27 ***	0.22 ***	0.23 ***	0.33 ***	0.27 ***	−0.04	−0.01	−0.26 ***	−0.12 ***	0.24 ***	0.18 ***	0.24 ***	0.11 ***	0.24 ***	**0.54** ***	0.30 ***	0.18 ***	0.04	0.17 ***	0.26 ***	0.25 ***	**0.60** ***	—

Note: Correlations observed in the theist group are presented under the diagonal, and in the atheist group—over the diagonal. SM = social media. p Values < 0.05 *, <0.01 **, <0.001 ***. Moderate and strong correlations ($\geq$0.5 and ≤ -0.5) are marked bold.

RQ1: Are there any differences and similarities between anxiety levels among religious and atheistic social media users?

In the studied sample, religiousness did not correlate with anxiety. Calculated Spearman's rho coefficients showed only one moderate correlation between trait anxiety and the avoidance coping strategy among both atheists ($\rho = 0.51$) and theists ($\rho = 0.50$).

RQ2: Are there any differences and similarities between coping strategies among religious and atheistic social media users?

Theists are more likely to search for social support as an answer to stressful online events (theists M = 1.454, atheists M = 1.336, $p = 0.00$), while atheists lean towards the problem-solving strategy (theists M = 1.840, atheists M = 1.999, $p = 0.00$). There was one correlation between the studied variables, i.e., the above-described relation between trait anxiety and avoidance coping.

RQ3: Are there any differences and similarities between online social support expectations among religious and atheistic social media users?

All four subscales were significantly different in both groups; in each case, atheists gained higher scores: esteem/emotional support (theists M = 1.143, atheists M = 1.569, $p = 0.00$), social companionship (theists M = 1.226, atheists M = 1.679, $p = 0.00$), informational support (theists M = 1.258, atheists M = 1.679, $p = 0.00$), and instrumental support (theists M = 0.852, atheists M = 1.190, $p = 0.00$). Moderate and strong positive correlations (from $\rho = 0.56$ to $\rho = 0.80$) between all subscales of online social support scales and all types of social media expectations as well as the intensity of social media usage were found for both groups. In the atheist group, moderate positive correlations ($\rho = 0.53$ to $\rho = 0.68$) occurred between all subscales of online social support and posting selfies, while in the theist group, this was only in the case of esteem/emotional support ($\rho = 0.57$).

RQ4: Are there any differences and similarities between discrimination experienced by religious and atheistic social media users?

Everyday discrimination was more pronounced among atheists (M = 0.416) than theists (M = 0.335), $p = 0.00$. Only weak correlations between the studied variables were found.

RQ5: Are there any differences and similarities between social media expectations among religious and atheistic social media users?

Atheistic users showed higher expectations concerning social media than religious ones: interpersonal (theists M = 1.849, atheists M = 2.422, $p = 0.00$), pragmatic (theists M = 2.245, atheists M = 2.831, $p = 0.00$), hedonistic (theists M = 1.827, atheists M = 2.369, $p = 0.00$), and compensatory (theists M = 1.497, atheists M = 1.962, $p = 0.00$). Despite internal correlations between subscales and with online social support (described in RQ3), interpersonal, hedonistic, and compensatory social media expectations were positively, moderately correlated with posting selfies in both groups (ρ ranging from 0.51 to 0.59 for theists and 0.53 to 0.68 for atheists). Atheists also showed a negative, moderate correlation between mood decreasing declarations due to social media and social media compensatory expectations ($\rho = -0.51$).

RQ6: Are there any differences and similarities between social media usage intensity among religious and atheistic social media users?

Social media usage intensity was higher among non-believers (theists M = 1.589, atheists M = 2.204, $p = 0.00$), with following correlations between the studied variables: online social support, social media expectations (as described in RQ3 and RQ5) and posting selfies ($\rho = 0.68$ for atheists and $\rho = 0.55$ for theists).

RQ7: Are there any differences and similarities between attitudes towards online behaviors related to hate speech among religious and atheistic social media users?

Being a hater and using vulgar language was more often declared by atheists (theists M = 0.363, atheists M = 0.441, $p = 0.001$; theists M = 0.790, atheists M = 1.094, $p = 0.00$, respectively). Only religious participants evinced positive, moderate correlation between being a hater and using vulgar language ($\rho = 0.60$).

RQ8: Are there any differences and similarities between attitudes towards the perceived influence of social media on mood, self-esteem, and life satisfaction among religious and atheistic social media users?

Posting selfies differed between groups (theists M = 0.975, atheists M = 1.657, $p = 0.00$). Using non-face avatars was more typical for religious participants (theists M = 1.195, atheists M = 1.075, $p = 0.029$). Perceiving social media as annoying, and causing a decrease in mood, self-esteem or life satisfaction did not correlate with religiousness. Most correlations concerning posting selfies have been already described. A moderate, negative one concerning using non-face avatars among atheists ($\rho = -0.50$) occurred. In the religious group, declarations about finding social media annoying were positively correlated with a decrease in mood ($\rho = 0.71$) and life satisfaction ($\rho = 0.51$) due to the use of such media. Non-religious participants evinced moderate but weaker, positive correlation between finding social media annoying and mood decreasing ($\rho = 0.61$), and a negative correlation between mood decreasing and social media compensatory expectations, as described in RQ5. Perceiving social media as mood decreasing also correlated positively with perceiving it as lowering self-esteem and life satisfaction in both groups (theists $\rho = 0.62$, atheists $\rho = 0.60$; theists $\rho = 0.63$, atheists $\rho = 0.64$, respectively). Drop in self-esteem was strongly, positively correlated with lowered life satisfaction due to social media (theists $\rho = 0.86$, atheists $\rho = 0.78$).

In the next step, ANNs were implemented. The best fitting model was MLP 44-126-2. Its quality of testing was estimated at 79.81%. The training algorithm was BFGS (Broyden–Fletcher–Goldfarb–Shanno algorithm), it was used to optimize the weights of the network and it took 11 epochs (learning cycles) to train. BFGS is one of the most recommended techniques used by the Statistica software for training ANNs. It may require a smaller number of epochs but is more demanding in terms of memory and computing. Tanh was an activation function for hidden neurons, while linear function was used for an output activation. Sum-of-squares was selected as the error function during the network training process.

A global sensitivity analysis was performed to verify the structure of the model. Conducting a sensitivity analysis shows the importance of individual network input variables and involves verifying the model's error behavior in response to changes with input variables. Specifically, for each input variable, its values are converted into an average from the training set to make it useless for the model and calculate the prediction error again. Such a procedure reveals the network's sensitivity to inputs. Scores of 1 or higher indicate that a variable improves the model. At the same time, these values cannot be interpreted directly, i.e., the higher the result, the more useful for the model is the variable. Variables in the MLP 44-126-2 all scored 1 or higher (Table 3).

Table 3. ANNs global sensitivity analysis (GSA).

Variable	GSA
Political views	1.591
Sexual orientation	1.435
Age	1.147
Place of residence	1.089
COPE_social support	1.037
OSSS_informational support	1.011
Gender	1.009
Posting selfies	1.007
COPE_problem solving	1.007
Relationship	1.006
SM mood decreasing	1.006
SM annoying	1.005
SM Intensity	1.003

Table 3. *Cont.*

Variable	GSA
OSSS_Social Companionship	1.003
Vulgar language	1.002
SM self-esteem decreasing	1.002
STAI_Trait Anxiety	1.001
SM life satisfaction decreasing	1.001
SM_Pragmatic expectations	1.001
COPE_positive thinking	1.001
STAI_State Anxiety	1.001
COPE_avoidance	1.001
OSSS_Esteem/Emotional Support	1.001
Everyday Discrimination	1.000
OSSS_Instrumental Support	1.000
SM_Compensatory expectations	1.000
SM_Hedonistic expectations	1.000
Non-face avatars	1.000
SM_Interpersonal expectations	1.000
Hater	1.000

RQ9: Are artificial neural networks capable of predicting religiousness of social media users based on their psychological traits and social behaviors?

In the studied sample, the ANNs model was able to predict correctly 79.81% of the variables. As for social science, such a result may be perceived as satisfactory (Kızılgeçit and Çinici 2020).

3. Discussion

This study aimed to explore the possible role of religiousness in online social behavior. By investigating psychological traits, perceptions, and attitudinal variables among religious individuals and atheists, it responded to the call made by scholars to expand religious studies to include the online arena (Cantone et al. 2022; Keating 2013; Sedlar et al. 2018). It has examined the relationship between religiosity, anxiety, coping, social support, discrimination, and social media expectations and behaviors using social media, and then checked whether these factors may serve as the foundation for the artificial neural networks model.

Several differences between atheists and theists were found. Religious individuals used social media to seek social support when coping with stress. Atheists, in contrast, preferred the problem-solving strategy as a coping mechanism, but also evinced higher expectations towards online social support, including its esteem/emotional, social companionship, informational and instrumental forms, as well as higher interpersonal, pragmatic, hedonistic, and compensatory expectations concerning social media. This is of particular interest considering another finding, i.e., that atheists have experienced more frequent online discrimination. This cohort also scored higher on social media usage intensity, which is especially worth noting through the lens of studies on the popularity of social media among religious people (Brubaker and Haigh 2017; Davidson and Farquhar 2014; Jafarkarimi et al. 2016; Laney 2005).

Using anonymous, non-face avatars was more typical for the religious part of the studied sample, while posting selfies was more typical for non-believers. A decrease in mood, self-esteem, and life satisfaction was not related to religiosity as it did not differ much between the groups, but non-religious participants evinced weaker correlation between finding social media annoying and mood decreasing. What is also worth noting is the finding that, although being a hater and using vulgar language was more often declared by atheists, only the religious group showed positive correlation between being a hater and using vulgar language. Finally, surprisingly, in this sample religiousness did not correlate with anxiety despite assumptions that social media amplifies such feelings (Qureshi-Hurst 2021).

As for the second part of this study, it aimed to show that it is possible to make predictions concerning religiousness using artificial-intelligence-based models. The designed network estimated approximately 80% of cases correctly, classifying individuals as theists and atheists based on their psychological traits and online social behavior. In the future, such a model may serve for further predictions on new data, being used directly in the software in which it was implemented or exported to a Predictive Model Markup Language (PMML) script.

To summarize, the current findings underscore previous research results, providing evidence of the impact of religiosity on online social activities. Moreover, for the first time, the study was extended to include a range of psychological traits. Additionally, the study used artificial neural networks to confront the religiosity with the studied variables as predictors of being a theist or an atheist. A review of the presented research indicated the need to broaden the scope of studies on online behaviors with religious perspectives, especially including non-believers. Therefore, a logical extension of this research was to analyze both groups—religious and non-religious individuals—and adopt an exploratory approach to the various psychological traits suggested in other studies.

The following limitations of the present study should be noted. The study employed a cross-sectional assessment. It would be valuable to conduct similar research, including longitudinal studies to provide solid and causal evidence for the nature of these associations. One limitation is the fact that many parallel tests took place and that the alpha error was not corrected due to the exploratory nature of the study. Finally, all the data were gathered using online questionnaires and psychological self-assessment scales and are only valid for screening purposes; a definitive diagnosis must rest on a clinical examination.

Thus, to provide a fuller picture of how religiosity relates to online activities, it will be necessary for future research to include data from a wider set, including longitudinal studies, more cultural diversity, and internal sample diversity. In particular, sexual orientation, which has been found to be a key factor for the prediction model, was underrepresented in the case of LGBTQ individuals. Another interesting, emerging path for future studies is exploring intergenerational attitudes toward religiosity manifestations in social media activities.

4. Materials and Methods

4.1. Sample and Procedure

A total of 1358 respondents (869 females, 489 males) aged 18–66 years (M = 29.64, SD = 12.40) volunteered to participate in this study and completed a questionnaire. Data collection began in late March 2022 and was completed in May 2022. Participants were recruited primarily via social media and snowball sampling. All Poland-based adults (18 years of age or older) were invited to engage in questions related to their religiousness: attitudinal variables on a 5-point Likert scale concerning online social behaviors (posting selfies, using non-face avatars, using hate speech, using vulgar language in social media, finding social media annoying, mood, self-esteem, and life satisfaction decreasing), and surveys: social media usage intensity, online social support, discrimination, anxiety, coping strategies, social media expectations, and demographics characteristics. All materials and procedures used in the study were approved by the Ethics Committee of the University of Lodz (8(II)/KBBN-UŁ/II/2020-21). Informed consent was obtained from all participants who were told that their participation was voluntary and that they could terminate their participation at any time. The participants did not receive a reward in any form.

For analyses comparing atheists and theists, 891 theists and 467 atheists participated in the study. Additional demographic variables can be seen in Table 4.

Table 4. Demographic variables: religiousness.

	Theists N = 891		Atheists N = 467	
	M	**SD**	**M**	**SD**
Social Media Intensity	1.589	0.984	2.204	0.924
Online social support—Esteem/Emotional Support	1.143	0.737	1.569	0.767
Online social support—Social Companionship	1.226	0.771	1.679	0.721
Online social support—Informational Support	1.258	0.759	1.679	0.724
Online social support—Instrumental Support	0.852	0.675	1.190	0.798
Everyday Discrimination	0.335	0.457	0.416	0.470
State Anxiety	0.365	0.456	0.399	0.526
Trait Anxiety	1.351	0.823	1.381	0.899
Coping—social support	1.454	0.541	1.336	0.518
Coping—problem solving	1.840	0.635	1.999	0.666
Coping—avoidance	1.259	0.583	1.273	0.624
Coping—positive thinking	1.713	0.592	1.794	0.589
Social media expectations—Interpersonal expectations	1.849	1.101	2.422	0.994
Social media expectations—Pragmatic expectations	2.245	1.089	2.831	0.760
Social media expectations—Hedonistic expectations	1.827	1.057	2.369	0.902
Social media expectations—Compensatory expectations	1.497	1.013	1.962	1.084
Posting selfies	0.975	1.163	1.657	1.543
Using non-face avatars	1.195	1.222	1.075	1.233
Social media annoying	1.418	1.090	1.433	1.095
Social media mood decreasing	1.165	0.999	1.120	0.969
Social media self-esteem decreasing	1.264	1.157	1.206	1.118
Social media life satisfaction decreasing	1.226	1.138	1.236	1.137
Hater	0.363	0.786	0.441	0.763
Using vulgar language	0.790	1.144	1.094	1.265
	N	(%)	N	(%)
Place of residence				
- big city >= 100 000 inhabitants	305	34.23	306	65.52
- small city < > 100 000 inhabitants	275	30.86	115	24.63
- village	311	34.90	46	9.85
Relationship				
- in relationship	553	62.07	200	42.83
- single	338	37.93	267	57.17
Sexual orientation				
- heterosexuality	855	95.96	347	74.30
- LGBTQ	36	4.04	120	25.70
Political views				
- right-wing	186	20.88	17	3.64
- neutral	538	60.38	159	34.05
- left-wing	167	18.74	291	62.31

4.2. Measures

The intensity of social media activities was measured by adopting the 13-item Facebook Intensity Scale (Drageset et al. 2013). This scale was primarily designed to assess Facebook usage beyond the scope of frequency and duration, including emotional connectedness to the site and its integration into daily activities, and marking out problematic vs. non-problematic aspects of Facebook use. With a series of attitudinal questions using a 5-point Likert scale concerning the extent to which the participants were emotionally connected to social media and integrated it into their daily activities (Ellison et al. 2007), within the adopted scale, the Cronbach's α was 0.81.

Online social support was assessed with the Online Social Support Scale (OSSS) (Nick et al. 2018), developed based on the theory of in-person social support. Online social support offsets the adverse effect of negative life events and counteracts the effects of online victimization, as does in-person social support. After the respondents answered forty 4-point Likert-scale questions about their social media use and the frequency of

particular things occurring during their online interactions over the last two months, the level of online social support felt by them was estimated with four subscales including: esteem/emotional support, social companionship, informational support, and instrumental support. Esteem/emotional support improves recipients' high esteem and emotional state by giving acceptance, intimacy, care, respect, empathy, or compassion; social companionship provides a sense of belonging; informational support includes aid in understanding and coping with problems; while instrumental support offers the provision of financial aid, material resources, and required services (Nick et al. 2018). In this study, the Cronbach's α was 0.83 for esteem/emotional support, 0.82 for social companionship, 0.85 for informational support, and 0.82 for instrumental support.

Online discrimination was included in this study using the 6-item Everyday Discrimination Scale. The term "everyday discrimination" refers to unfair treatment that manifests itself as daily affronts and insults in everyday settings. The scale represents a general measure of everyday discrimination regardless of the reasons for its occurrence (Clark et al. 2004; Mitchell et al. 2020), using a 4-point Likert-scale. The Cronbach's α was 0.80.

State anxiety, indicating the intensity of feelings of anxiety, was measured using the State-Trait Personality Inventory (STAI) (Spielberger et al. 1983). It is a 40-item measure on a 4-point Likert-scale, used to assess state anxiety, which is a temporary condition experienced in specific situations, and trait anxiety, which illustrates a general tendency to perceive situations as ominous (Zarzycka et al. 2017). Although both subscales were included in this study, the author focused on trait anxiety over state anxiety because she intended to measure the overall condition of respondents rather than a temporary state. The Cronbach's α was 0.79 and 0.81 for the state and trait subscales, respectively.

Coping refers to cognitive and behavioral efforts that are implemented to solve problems and reduce the stress associated with these difficulties (Baumstarck et al. 2017). The strategies for stressful situations depend on the person's emotional status and cognitive evaluation of the stressor (Folkman and Moskowitz 2000). In this study, the preferences for coping strategies under a situational or dispositional approach were measured using the Brief Coping Orientation to Problems Experienced (Brief COPE). It is an abbreviated version of the Coping Orientation to Problems Experienced (COPE) inventory consisting of 60 questions with 14 different coping strategies (Carver et al. 1989). The short, 28-item version was designed to reduce the administration and time burden (Baumstarck et al. 2017). Instead of 14 strategies, the Brief COPE introduces four dimensions of coping: social support, problem solving, avoidance, and positive thinking (Carver 1997), using a 4-point Likert scale. With an easier structure with fewer factors, it is widely used by healthcare professionals and researchers (Baumstarck et al. 2017). Internal consistency reliability ranged between 0.78 and 0.81 (the Cronbach's α was 0.79 for social support, 0.81 for problem solving, 0.81 for avoidance, and 0.78 for positive thinking).

Social media expectations have been assessed by adopting the Expected Effects of Internet Usage. It is a 40-item measure implementing a 5-point Likert scale, researching the positive effects of online activities on four subscales: interpersonal, pragmatic, hedonistic, and compensatory expectations (Poprawa 2009). Interpersonal expectations refer to the optimization and enrichment of social relations, getting to know and getting closer to other people. Pragmatic expectations are the facilitation of communication, the acquisition of useful information, and personal development. Hedonistic expectations focus on mood improvement and entertainment, and compensatory expectations include pursuing transformation and freeing oneself from complexes and low self-esteem. Cronbach's alpha coefficients ranged from 0.73 to 0.79 for all dimensions, indicating satisfactory internal consistency (0.74 interpersonal, 0.73 pragmatic, 0.79 hedonistic, and 0.73 compensatory expectations).

4.3. Statistical Analysis

All statistical analyses were conducted with the statistics program Statistica 13.3.0 (Tibco Software Inc., Palo Alto, CA, USA). A preceding data exploration showed that there

were no missing or extreme values in the data set. Checking the variables for homogeneity of variance with the Levene's test and for normality with the Shapiro–Wilk (S-W) test obliged the author to use the Mann–Whitney U test with the continuity correction while comparing theists and atheists. Next, the correlation matrix (rho-Spearman) between the variables was calculated. All analyses had the level of significance set at $p < 0.050$. Due to the exploratory nature of this study, Bonferroni-adjusted post hoc tests were not carried out, despite the substantial number of statistical tests, following the approach by von Wietersheim and others (von Wietersheim et al. 2012).

In the next step, a set of ANNs was implemented and trained to create a classification model based on the religiousness of respondents. The data were divided into three subsets: training (70%), testing (15%), and validation (15%). Several different iterations with varying configurations of network settings were performed, and the best results were saved. Two types of ANNs algorithms were implemented: multilayer perceptron (MLP) and radial basis function (RBF). The first one consists of three layers: input, hidden (one or more), and output. RBF network has the same structure, but there is a single hidden layer (Fath et al. 2018; Kalogirou 2000). In this study, network architecture consisted of three layers: input (44 neurons due to the amount of input variables including all their possible values), hidden (number of neurons set automatically in the training process, ranging depending on a network type: MLP from 7 to 200, RBF from 21 to 200; minimum values set automatically, maximum estimated experimentally in subsequent iterations), and output (2 neurons as for classification results: atheist, theist).

5. Conclusions

Despite the limitations, the study showed that religiosity is an important factor to include in online social behavior research. It examined religiosity from the perspectives of anxiety, coping, social support, discrimination, and social media expectations and behaviors. As it aimed at bridging the research gap between religiosity and social media by investigating the above factors, these findings may be of value for researchers dealing with religion, social media communication and its influence on individuals, as well as modern societies and cultural norms.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of by the Ethics Committee of the University of Lodz (8(II)/KBBN-UŁ/II/2020-21).

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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