0 Preamble

0.0 Initialize Environment

Start Warning

Run the following only if you need to **initialize** source data for the entire project environment.

In [ ]:
```
%run grabSource.py
```

Run the following only if you need to **overwrite** source data for the entire project environment.

In [ ]:
```
%run grabSource.py overwrite
```

End Warning

0.1 Global Packages

In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

0.2 Local Packages

In [2]:
```
from ingestRaw import *
from segmentData import event_timeline
```

0.3 Import Data

In [3]:
```
memberIdeas_raw = ingestMemberVote()
```

1 Data Mining

1.1 Verify Data Types

In [4]:
```
memberIdeas_raw.dtypes
```

Out[4]:
```
congress                          Int64
chamber                          object
icpsr                             Int64
state_icpsr                       Int64
district_code                     Int64
state_abbrev                     object
party_code                        Int64
occupancy                         Int64
last_means                        Int64
bioname                          object
bioguide_id                      object
born                              Int64
died                              Int64
nominate_dim1                   float64
nominate_dim2                   float64
nominate_log_likelihood         float64
nominate_geo_mean_probability   float64
nominate_number_of_votes          Int64
nominate_number_of_errors         Int64
conditional                      object
nokken_poole_dim1               float64
nokken_poole_dim2               float64
dtype: object
```

1.2 Initial Distributions

In [5]:
```
memberIdeas_raw.describe(include= 'all').transpose()
```

Out[5]:

	count	unique	top	freq	mean	s
congress	50494.0	<NA>	<NA>	<NA>	69.777875	30.6823
chamber	50494	3	House	40474	NaN	Na
icpsr	50494.0	<NA>	<NA>	<NA>	9793.048521	10204.6080
state_icpsr	50494.0	<NA>	<NA>	<NA>	33.722403	20.5521
district_code	50494.0	<NA>	<NA>	<NA>	9.291896	16.3099
state_abbrev	50494	57	NY	4356	NaN	Na
party_code	50494.0	<NA>	<NA>	<NA>	226.151087	656.3899
occupancy	48213.0	<NA>	<NA>	<NA>	0.131583	0.526
last_means	48213.0	<NA>	<NA>	<NA>	1.225022	0.6718
bioname	50494	12363	DINGELL, John David, Jr.	30	NaN	Na
bioguide_id	50427	12500	D000355	30	NaN	Na
born	50245.0	<NA>	<NA>	<NA>	1875.579063	58.1557
died	40832.0	<NA>	<NA>	<NA>	1931.263396	55.5343
nominate_dim1	50273.0	NaN	NaN	NaN	0.006429	0.3755
nominate_dim2	50273.0	NaN	NaN	NaN	0.015534	0.4633
nominate_log_likelihood	49264.0	NaN	NaN	NaN	-102.654665	93.4930
nominate_geo_mean_probability	49264.0	NaN	NaN	NaN	0.753488	0.0985
nominate_number_of_votes	49264.0	<NA>	<NA>	<NA>	391.091811	330.5794
nominate_number_of_errors	49264.0	<NA>	<NA>	<NA>	46.260616	43.50
conditional	0	0	NaN	NaN	NaN	Na
nokken_poole_dim1	50028.0	NaN	NaN	NaN	0.005928	0.3929
nokken_poole_dim2	50028.0	NaN	NaN	NaN	0.013432	0.4867

1.3 Preliminary Filtering

The US is primarily controlled by the two-party system of Republicans and Democrats. The source data accounts for all variations and recognized sub-parties affecting the Congressional bodies. For the simplicity of this report, along with the de minimus values available for all non-dominant parties, we reduce the source data to only members of the Republican or Democratic parties within the House or Senate bodies. Additionally we

exclude any information of the first 32 Congressional Sessions due to weak, missing, or unviable data; note that some data is weak until the 40th Congress and will reduce analysis ad-hoc to accomodate those early Sessions as outlier entities.

In [6]:
```
partyInclude = [100, 200]
memberIdeas_clean = memberIdeas_raw.query(
    f"party_code in {partyInclude}"
)
memberIdeas_clean = memberIdeas_clean.query(
    f"chamber != 'President'"
)
memberIdeas_clean = memberIdeas_clean.query(
    f"congress > 33"
)
memberIdeas_clean = memberIdeas_clean.drop(
    columns= [
        'state_icpsr',
        'district_code'
    ]
)
memberIdeas_clean['party'] = memberIdeas_clean['party_code'].apply(lambda x: 'Repub
```

1.4 Final Distributions

In [7]:
```
memberIdeas_clean.describe(include= 'all').transpose()
```

Out[7]:

	count	unique	top	freq	mean	st
congress	41675.0	<NA>	<NA>	<NA>	79.73159	22.9849
chamber	41675	2	House	33621	NaN	Na
icpsr	41675.0	<NA>	<NA>	<NA>	10422.627522	9612.2158
state_abbrev	41675	56	NY	3325	NaN	Na
party_code	41675.0	<NA>	<NA>	<NA>	147.577684	49.94188
occupancy	39456.0	<NA>	<NA>	<NA>	0.109008	0.48262
last_means	39456.0	<NA>	<NA>	<NA>	1.170519	0.60162
bioname	41675	9183	DINGELL, John David, Jr.	30	NaN	Na
bioguide_id	41673	9210	D000355	30	NaN	Na
born	41666.0	<NA>	<NA>	<NA>	1893.629746	44.67779
died	32146.0	<NA>	<NA>	<NA>	1952.076992	40.74626
nominate_dim1	41534.0	NaN	NaN	NaN	0.006089	0.37671
nominate_dim2	41534.0	NaN	NaN	NaN	0.015197	0.45390
nominate_log_likelihood	40848.0	NaN	NaN	NaN	-105.62572	97.94616
nominate_geo_mean_probability	40848.0	NaN	NaN	NaN	0.765104	0.09398
nominate_number_of_votes	40848.0	<NA>	<NA>	<NA>	420.511628	347.09232
nominate_number_of_errors	40848.0	<NA>	<NA>	<NA>	47.040614	45.24539
conditional	0	0	NaN	NaN	NaN	Na
nokken_poole_dim1	41424.0	NaN	NaN	NaN	0.005436	0.39379
nokken_poole_dim2	41424.0	NaN	NaN	NaN	0.011439	0.47613
party	41675	2	Democrat	21847	NaN	Na

1.5 Transformations

The data provided is at an individual Members' level of detail; this report is consolidating the values into Congressional Session, House, and Party levels to run consensus analysis.

In [8]:
```
cpIdeas = memberIdeas_clean.groupby(['congress', 'party']).agg(party_mean= ('nomina
ccIdeas = memberIdeas_clean.groupby(['congress', 'chamber']).agg(chamber_mean= ('no
cIdeas = memberIdeas_clean.groupby(['congress']).agg(Congress= ('nominate_dim1', 'm
ccIdeas = ccIdeas.pivot(columns= 'chamber', index= 'congress', values= 'chamber_mea
cpIdeas = cpIdeas.pivot(columns= 'party', index= 'congress', values= 'party_mean')
```

```
compositeIdeas = pd.merge(
    cIdeas, ccIdeas,
    how= 'outer',
    on= 'congress'
)
compositeIdeas = pd.merge(
    compositeIdeas, cpIdeas,
    how= 'outer',
    on= 'congress'
)

compositeIdeas['Republican Congress Delta'] = compositeIdeas['Republican'] - compos
compositeIdeas['Democrat Congress Delta'] = compositeIdeas['Democrat'] - compositeI
compositeIdeas['Party Delta'] = compositeIdeas['Republican'] - compositeIdeas['Demo
compositeIdeas['Year'] = compositeIdeas['congress']*2 + 1787
compositeIdeas
```

Out[8]:

	congress	Congress	House	Senate	Democrat	Republican	Republican Congress Delta	Democra Congres Delt
0	34	-0.378183	-0.385570	-0.362300	-0.391476	0.446000	0.824183	-0.01329
1	35	-0.113215	-0.086022	-0.204794	-0.384049	0.315409	0.428624	-0.27083
2	36	-0.049733	-0.011200	-0.165897	-0.428016	0.284200	0.333933	-0.37828
3	37	0.082035	0.139873	-0.064785	-0.290925	0.280947	0.198912	-0.37296
4	38	0.067766	0.053925	0.116978	-0.288812	0.320342	0.252576	-0.35657
...	...	...	...	...	...	...	...	
80	114	0.105069	0.103372	0.112704	-0.383235	0.479702	0.374633	-0.48830
81	115	0.099821	0.098927	0.103728	-0.378657	0.488879	0.389058	-0.47847
82	116	0.047788	0.033542	0.111610	-0.366427	0.499947	0.452158	-0.41421
83	117	0.061038	0.053013	0.097550	-0.373555	0.506734	0.445696	-0.43459
84	118	0.076630	0.072007	0.097765	-0.377563	0.514486	0.437856	-0.45419

85 rows × 10 columns

2 Timeseries Analysis

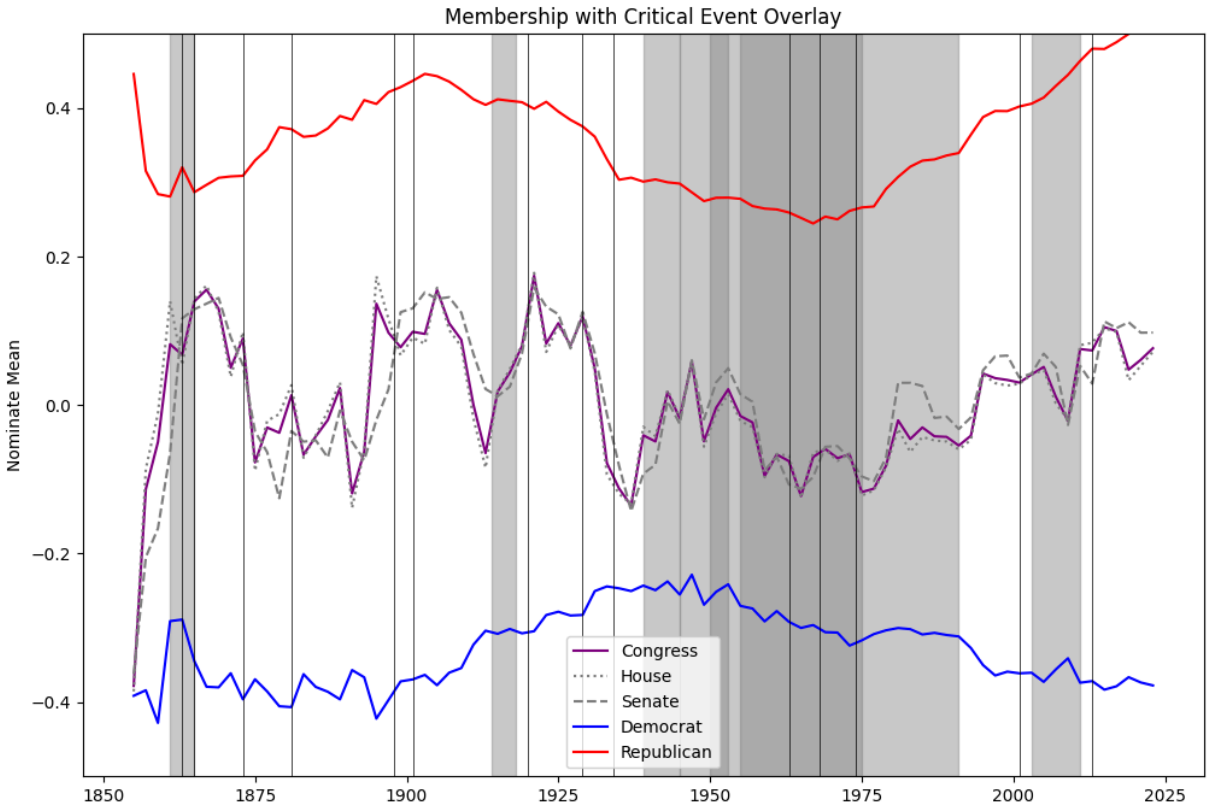
2.1 Nominate Mean Overlays

In [9]:

```
fig, ax = plt.subplots(figsize=(12, 8))
ax.plot(compositeIdeas['Year'], compositeIdeas['Congress'], label='Congress', color
ax.plot(compositeIdeas['Year'], compositeIdeas['House'], label='House', color='gray
ax.plot(compositeIdeas['Year'], compositeIdeas['Senate'], label='Senate', color='gr
```

```
ax.plot(compositeIdeas['Year'], compositeIdeas['Democrat'], label='Democrat', color
ax.plot(compositeIdeas['Year'], compositeIdeas['Republican'], label='Republican', c
ax.set_ylim([-.5, .5])
for row in event_timeline.itertuples():
    if pd.notna(row.stop):
        ax.axvspan(row.start, row.stop, color= 'gray', alpha=0.4)
    else:
        ax.axvline(x= row.start, color= 'black', linestyle= 'solid', linewidth= .5)


# Shade the area between 1860 and 1865 with 50% transparency
# ax.axvspan(1860, 1865, color='gray', alpha=0.5)
ax.legend()
plt.title("Membership with Critical Event Overlay")
plt.ylabel("Nominate Mean")
plt.show()
```

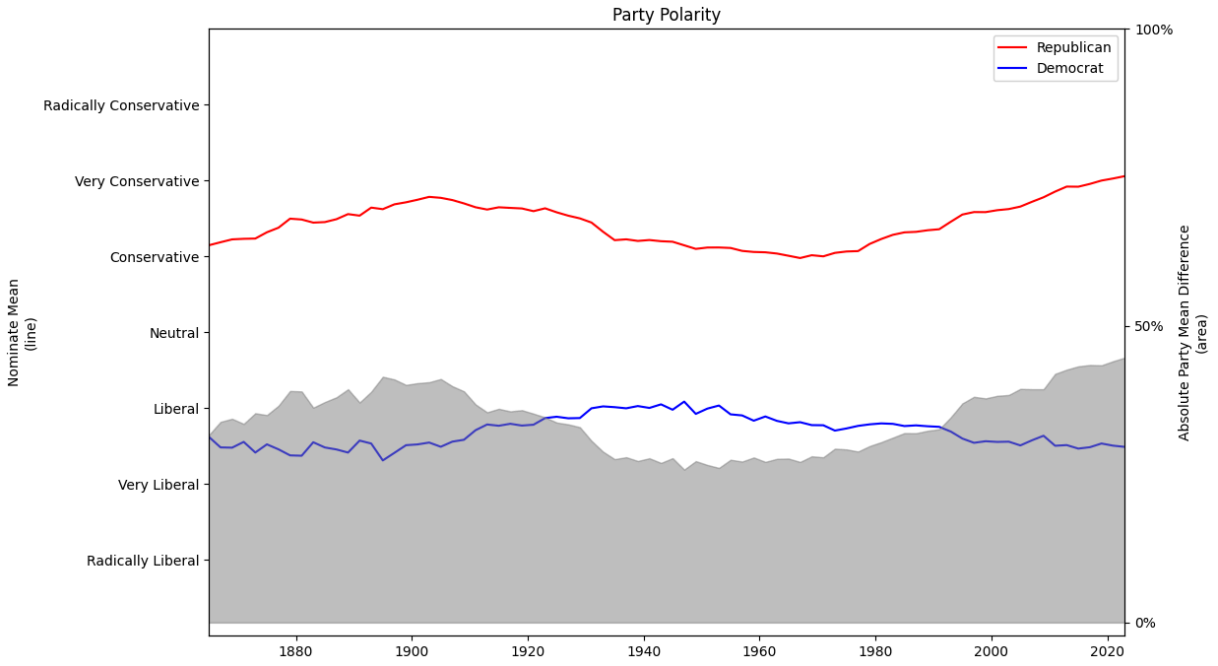


Above is the nominate mean scores over time with a subset overlay of major US and US-Global political, sociological, economica, and terrorstic events. Solid black bars represent a single instance whereas shaded areas denote campaigns lasting more than a year, such as wars. This dense graph provides us with several significant points to consider:

1. Nominate scores of the Senate and House do not deviate significantly from the composite Congressional body. This suggests we can analyze Congress as a whole in the same way we would facet information between the House and Senate.
2. Major events do not appear to impace the peaks or valleys in a way that would suggest one party is more adept at handling issues affecting the country holistically better than the other.

3. The end of the New Deal Coalition in 1969 marks a time of significant unrest in the country, gernered by the density and frequency of major events in the decade. This era is a clear turning point in American politics and the beginning of the modern polarity in political opinion. This finding is in alignment with several professional publications on the 'Sixth Party System'.
4. The overall Congressional Session appears to drift more Conservative as the Nominate mean difference increases, both in recent history and at the turn of the 20th century when the divide was similarly large.

In [10]:
```
fig, ax = plt.subplots(figsize=(12, 8))
ax.plot(compositeIdeas['Year'], compositeIdeas['Republican'], label='Republican', c
ax.plot(compositeIdeas['Year'], compositeIdeas['Democrat'], label='Democrat', color
bx = ax.twinx()
bx.fill_between(compositeIdeas['Year'], compositeIdeas['Party Delta'], color= 'gray
ax.legend()
ax.set_ylim([-1, 1])
ax.set_ylabel('Nominate Mean\n(line)')
ax.set_yticks(
    [-.75, -.5, -.25, 0, .25, .5, .75],
    ['Radically Liberal', 'Very Liberal', 'Liberal', 'Neutral', 'Conservative', 'Ve
)
#bx.set_yscale('log')
bx.set_ylabel('Absolute Party Mean Difference\n(area)')
bx.set_yticks(
    [0, 1, 2],
    ['0%', '50%', '100%'],
)
plt.xlim([1865, 2023])
plt.title("Party Polarity")
plt.show()
```

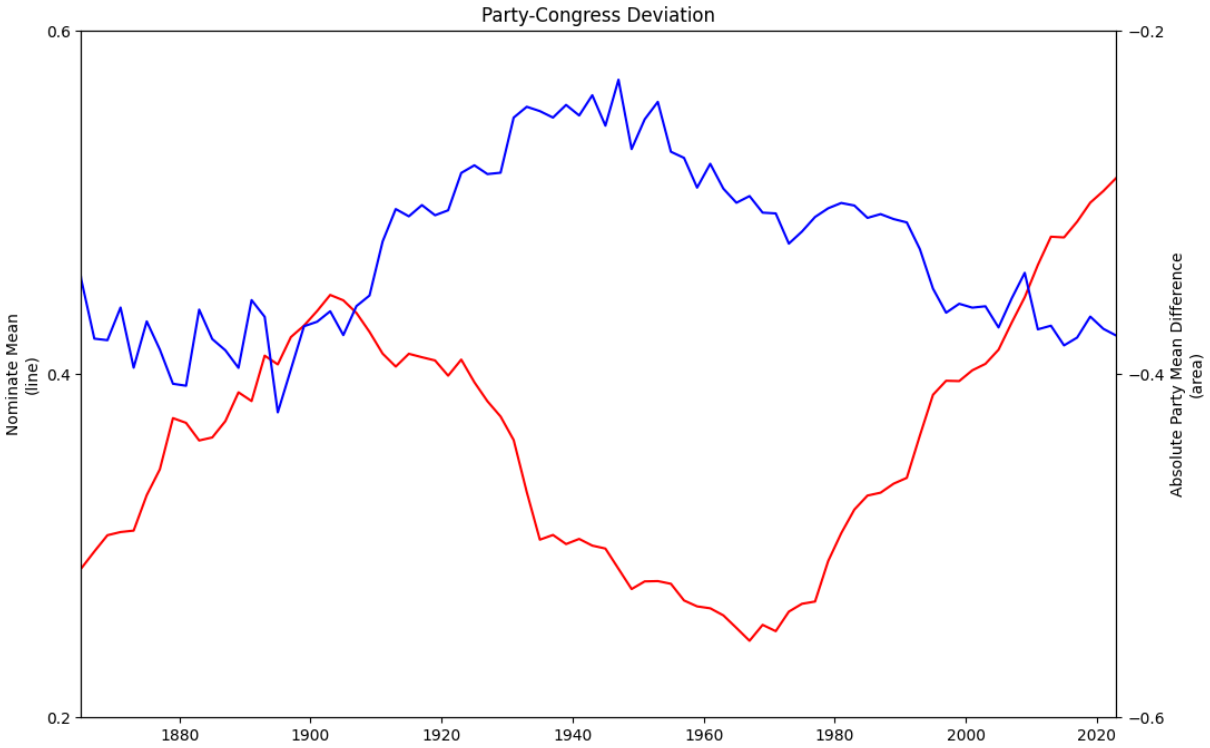


In [11]:
```
fig, ax = plt.subplots(figsize=(12, 8))
ax.plot(compositeIdeas['Year'], compositeIdeas['Republican'], label='Republican', c
```

```
bx = ax.twinx()
bx.plot(compositeIdeas['Year'], compositeIdeas['Democrat'], label='Democrat', color

ax.set_yticks(
    [.2, .4, .6]
)
ax.set_ylabel('Nominate Mean\n(line)')

bx.set_ylabel('Absolute Party Mean Difference\n(area)')
bx.set_yticks(
    [-.2, -.4, -.6]
)
plt.xlim([1865, 2023])
plt.title("Party-Congress Deviation")
plt.show()
```



The Party Polarity Timeline tracks the individual Parties along with their absolute mean difference. This plotting suggests that while the deviation has increased, it is not as much about the radicalization of both parties as it is the radicalization of the Republican Party against a less-volitile change in the Democratic Party.

This notion is further supported when comparing the deviation of the Parties against the Nominate means of the whole Congressional Session. The radicalization of the Right is increasing on both spectrums, causing a nominal spread and rebellion against other constituent bodies.